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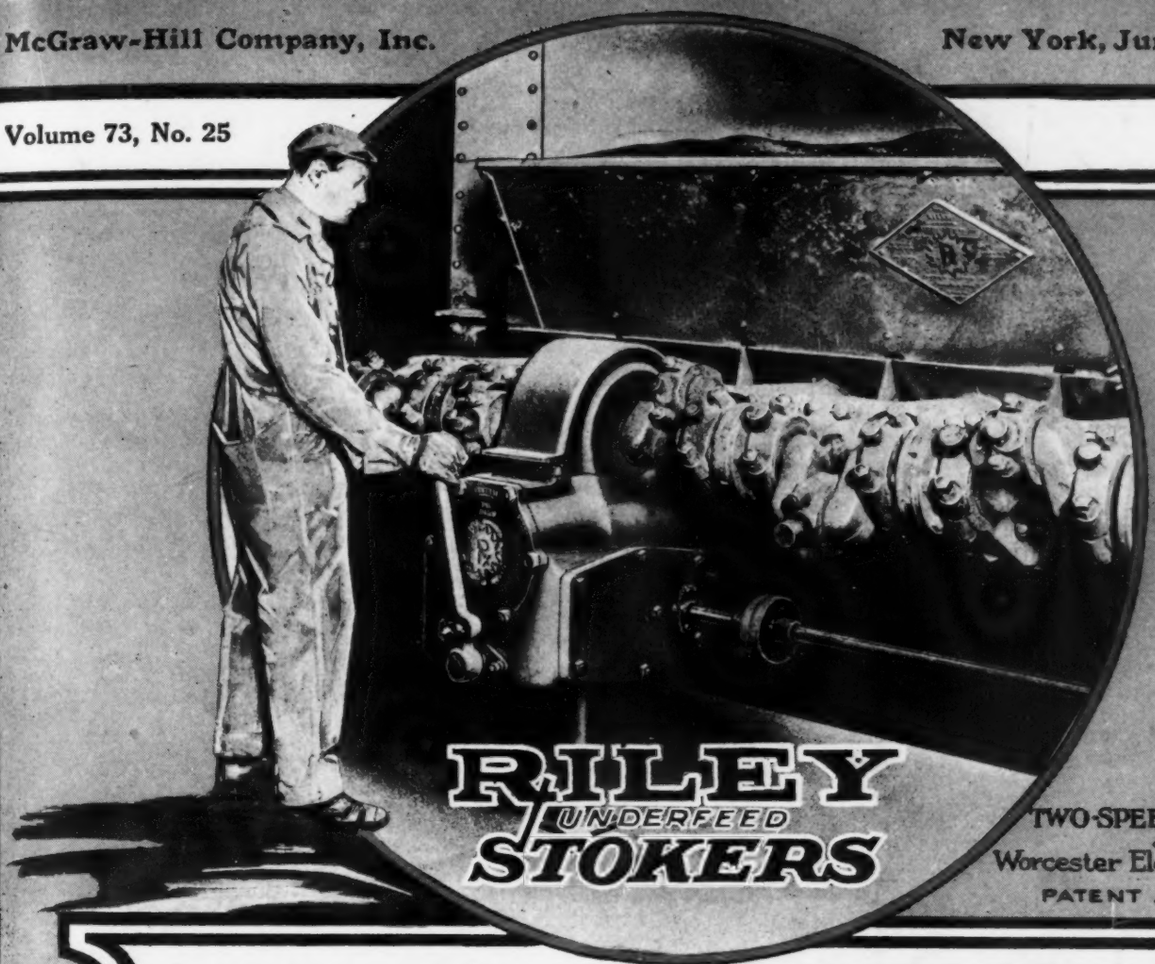

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Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Honor to the Pioneers

TO THE man who looks around him and sees the giant's part that electricity plays in human affairs its beginnings seem infinitely small. From the Leyden jar to the mammoth generator, from the voltaic pile to the high-tension transmission line, from all the crude adaptations at which men not yet old marveled to the things that are a matter of course to the child of to-day, the distance is as great as that between the primer of infancy and the library of Congress. Yet in the experiments and theories and written records of the early electrical scientists—the men who made possible the inventors and manufacturers of yesterday and to-morrow—lay the intellectual protoplasm from which has evolved the art as the early twentieth century knows it and as in still mightier manifestations the generations to follow will know it. To the memory of these men the profession should pay tribute when the opportunity comes to halt for a moment in the steady march of achievement and look back through the vista of scientific history to the cradles on the horizon and the milestones along the way.

The ELECTRICAL WORLD presents to its readers with this issue a supplement entitled "A Glance at Early Electrical Literature," which aims to afford such a backward look, not in perfect perspective or with all-embracing vision, but, it thinks, with the greatest figures from Gilbert to Kelvin plainly indicated and with enough of the lesser men grouped around them to prevent any unhistorical aspect of isolated grandeur. The sketch makes no pretense to deep research or unfamiliar assertion, any more than to completeness; its object is rather to throw around portraits and book titles which should not be unknown to electrical engineers a touch of that "human interest" sometimes sadly lacking in the unemotional rerords of science.

Never judge a convention by the number of sessions or the array of papers. Human beings severally and collectively thrive least when stuffed most. One good committee report will save a session and two more will make a convention. Attempt little and accomplish much is a good motto for convention committees to follow.

Baiting the Commissions

IN THE legislatures of several states, of which Illinois and Missouri are quite typical, well-organized lobbies have been or are being maintained for the purpose of repealing entirely or placing limiting clauses in the public utility commission laws. Municipalities are the supporters of these lobbies. Superficially one may say that their purpose is to put the utilities back into local politics, for obvious reasons. Viewed from another angle, however, it may appear that they are expressing a sentiment against a new phase of utility regulation and against "war-quality" service.

For instance, one of the main points around which the fight has hinged is the commissions' authority to set aside franchise rates and obligations. This authority was not questioned, of course, until it began to operate in favor of the utilities. That it will withstand all attacks seems fairly certain, for the legislatures are reported in most instances to be treating the attacks on utility commissions quite fairly. In fact, it is from the thoughtful actions of these state bodies that both the municipalities and the utilities may draw a lesson. The municipalities will learn that it is futile, and is not considered entirely patriotic, to bait utilities commissions which are acting in direct line with suggestions of the President of the United States. The utilities will learn that there is a limit beyond which they should not go in insisting that commissions fight their battles, and a limit in quality of service, anything below which the public should not be asked to endure.

Where is the community which has become electrically saturated? The larger the demand for service and electrical conveniences, the greater the market becomes. The time will come when present practice in limiting outlets for home service will look like cheeseparing in comparison with the intensified utilization of electricity lying ahead of the industry and being realized on a larger scale every year.

Army Development of Battery-Charging Sets

IN WARS previous to that which is now being closed the armies in the field had to be supplied with batteries for telegraphic and telephonic service. Those batteries, however, were neither very numerous nor very heavy. In most cases they were primary batteries, and when exhausted they were discarded. In this war, however, radio-communication took a very prominent part. Large numbers of storage batteries had to be provided. These batteries had to be regularly charged from generators. Portable generating sets had to be set up at every headquarters, often down to regimental headquarters. The generating sets were usually gasoline engines, driving direct-current generators, although, among the different armies, various types of engine and generator could be found.

Small battery-charging generator sets were in well-established use before the war all over the world, but they were ordinarily not well adapted to army needs. They were not sufficiently portable or sufficiently rugged. They were designed as inexpensively as possible, and an occasional breakdown was not unexpected. In

army service the first cost of the generator set became of small importance by comparison with ruggedness, portability and reliability.

It became necessary for the Signal Corps to develop a suitable generating set for army service, in order to meet the needs of the expeditionary force with the least delay and greatest effectiveness. The history of that development is outlined this week in an article by Capt. A. E. Flowers. It would be interesting to learn what will happen to these sets with the full return of peace. It seems likely that they will disappear in favor of less expensive, less portable and more competitive designs. It is earnestly to be hoped, however, that the sets will not become lost altogether.

Without wishing to profit ungenerously by others' misfortunes, it none the less might be said that a recent gas company strike in a New England city did more to advertise the value of electric cooking and heating devices than the contractor-dealers of the community could have compassed in many months of united publicity. Empty mains produced a drive on the appliance shops which practically cleaned out the town in a few hours. The gas returned, but thousands of people who had never before given electric cooking serious thought will henceforth know its benefits.

The Efficiency of the Turbo-Alternator

IT IS customary to call for a certain percentage of efficiency in a turbo-alternator, but it is very difficult to determine by test what the actual efficiency is under load. The ordinary conventional method is to measure the individual stray losses with care at no load, and to compute the copper losses, under load, from the observed resistance of the armature. The efficiency under rated load is then reckoned by dividing the rated ouput by the sum of the rated output plus all the anticipated losses. It is generally admitted that there will be certain additional losses in the machine under actual load, over and above those which can be measured and estimated for no load. Such extra losses are usually referred to as "load losses." It is possible to estimate these load losses from certain tests made with the armature on short circuit. The efficiency arrived at in this way is a perfectly proper conventional efficiency that has been found more or less satisfactory in practical experience. Nevertheless, it is always desirable to be able to test a turbo-alternator for efficiency under actual load conditions, when a steady load can be obtained.

A recent article on this subject in the *Electrician* of London, by S. F. Barclay and S. P. Smith, gives some interesting results based on the measurement of the heat carried away from the alternator by cooling air under measured forced draft. In such tests the alternator has to be completely incased, so that the cooling air can be supplied to it under definitely measurable conditions as to rate of flow and temperature elevation. The principle is identical with that often used in the case of water-cooled transformers, where the power lost in the transformer under steady load is determined from the rate of flow of cooling water and the temperature elevation of the same.

It is doubtful whether the air-heating method can be made available for acceptance tests, owing to the heavy load which large turbo-alternators carry and the practical difficulties in securing this large steady load at the factory for a sufficient length of time. Nevertheless, the method should be capable of being applied to turbo-alternators in service, and at a relatively small expense.

An electrical Fourth of July is a safe and sane Fourth. Invite every householder to help in the celebration by displaying in his front window or on his front porch an American flag, lighted from behind by an electric lamp. Ask that during the hours of the evening celebration every front window and porch light be illuminated. Suggest that every housewife place her handsomest portable lamp in a front window in honor of the "boys from over there."

Grounding the Neutral

EVER since three-wire systems of distribution came into use there has been a difference of opinion as to whether the neutral should be grounded or not. The advantages have naturally not been all on one side of this controversy. Each side of the question has its advantages and disadvantages, but the preponderance of advantage has been on the side of grounding the neutral.

In the days of the low-tension three-wire direct-current system and before the introduction of the polyphase system the question was acute. The disadvantage of grounding was that any ground made on an outside wire became a short circuit and was therefore accompanied by disturbance. The advantage of grounding was that the electrical stresses on the outside conductors were limited to their normal working value. In the long run the policy of grounding the neutral was generally followed.

With the use of three-phase distribution systems the same question has become active under a new form. If the neutral of the system is permanently grounded, the electrical stresses on the three mains cannot ordinarily exceed their normal working values, but an accidental ground coming anywhere on the system becomes at once a short circuit. Under unfavorable conditions the short circuit may attain great violence. Is it better to run without grounded neutral and trust to being able to clear off each ground as it occurs before a short circuit can develop, even if the voltage on the other mains becomes greatly increased, or is it better to run with a permanent ground and take the short-circuits without question and smilingly as part of the day's work?

This question will be dealt with by H. R. Woodrow in a paper before the Lake Placid (N. Y.) convention of the American Institute of Electrical Engineers next week. The paper, which is well worth study by operating engineers, describes four different methods of grounding procedure that have been tried in the New York Edison district. In general, it appears to be indicated that grounding the neutral of such a system is good policy, provided, first, that the ground shall be made through such resistance as will automatically limit the flow of current in case of a short-circuiting ground elsewhere, and, second, that special ground relays are installed, to cut off very quickly and automatically any feeder on which a short-circuiting ground develops.

Equipment for Industrial Lighting

THE article we publish this week by Ward Harrison and H. H. Magdsick is the beginning of a careful study of equipment suitable for industrial lighting. The present section takes up the preliminary requirements in an extremely comprehensive manner and should prove of very great use in meeting the practical requirements of manufacturing plants. Several of the suggestions are particularly well worth heeding, and in particular we may mention the specification of sufficient light on all working sufaces, however situated. In the codes for factory lighting which have been generally adopted the usual practice has been to specify measurement of the light on the horizontal plane, which is the commonest plane involved. Such specification is probably very sound practice since it is specific and easy to measure, but there are cases where the vertical plane, for instance, is of much importance, and the authors point out that in general terms with any ordinary system this vertical intensity will be about one-half the horizontal intensity and that due allowance must be made for this fact. The question of color of light is, within the range of ordinary illuminants, not commonly a serious one; but for certain purposes an approximation to daylight is highly desirable, while occasionally for critical inspection of product a nearly monochromatic source has distinct advantages. One fact which cannot be too thoroughly impressed is that an object is seen by the light which it reflects, and consequently things like dark fabrics demand an intensity of illumination all out of proportion to average conditions. Again, in certain fine mechanical work the degree of diffusion is a very important matter, limited on the one hand by the danger of reflections and on the other by the lack of contrast due to extreme diffusion.

We wish to point out particularly the treatment here of the general illumination which falls on surfaces surrounding the working plane. The value of light walls and ceilings can hardly be overestimated, both in adding to the general effectiveness of the illuminants and in reducing the contrast between the working light and that which lies about it. All changes from light to darkness or the reverse, whether incurred by passing from one to the other bodily or by merely looking from one to the other, involve adaptive changes of vision which if too severe may be extremely troublesome. The universal use of light paint and whitewash goes far toward ameliorating the visual conditions in any factory. Still another point worth considering is the effect of absolute intensity on the eye, aside from intrinsic brilliancy. One is sometimes tempted to think that glare is dependent on the latter factor alone, which is not at all the case, although it is commonly an important factor. Probably the ultimate measure of glare is the intensity of the light image on the retina taken in absolute measure. This determines the photochemical changes involved in the act of vision, and consequently a very powerful source, even if considerably reduced in intrinsic brilliancy, may deliver as much energy per unit of area in the retina as would a much brighter source of far less total power. The more one studies the question of glare the more complicated it becomes, and the effect of image formation is one of the elements which have been given somewhat insufficient consideration. We shall await with interest the more detailed study of practical lighting units promised by the authors.

Government ownership is a moribund issue at present, but no greater mistake could be made than to assume that opposition to it is unanimous. It behooves public utilities to prove by the best possible service at the most reasonable rates that any further experiments in government operation would be economic and political calamity.

Reinsulation of Large Generators

THERE are two dangers that attend the sustained operation of large central-station generators. One is accidental short circuit, due to some failure of insulation outside of the machine, whereby intensely severe electromechanical stresses may be brought to bear upon the generator. The other is a breakdown in internal insulation, with the probability of an internal short circuit thereby produced. The short circuit is always the accident to be feared. External short circuits can be guarded against, partly by care in external construction and partly by the use of suitable protective reactances. Internal short circuits are often more insidious and more difficult to forefend. They may be due to accidental weak points in construction, to overheating and overloading, or to the puncture of insulation by overvoltage or mechanical injury to coils during operation. Such accidents have been caused by the magnetic indrag of a hoisting chain into a running machine.

An article in this issue deals with the inspection, overhaul and repair of alternator insulation. An alternator armature, in large sizes, is apt to embody a considerable percentage of the capability for output from a central station. In periods of heavy load upon the station the loss of an armature by internal short circuit may not only constitute a serious accident but may also cripple the plant and lead to the overloading of all the remaining units at the very time when these units need to be protected to the utmost. The narrative of events given in the article suggests the advisability of a thorough inspection of the insulation in central-station armatures during the summer months, when the load is likely to be at its lowest for the year. If defects of insulation exist, owing to overheating, such defects are likely to occur in any or all coils, with but little preference for the ends of the winding. In the case, however, of defects due to overvoltage stresses from surges, these defects are more likely to occur in the end coils, or even in the end turns of the end coils, when the dielectric strength is uniformly distributed throughout the winding.

As regards protection from insulation damage due to overheating, probably the best lies in the use of embedded thermocouples, built into the armature and connected permanently to temperature indicators mounted on the switchboard. The switchboard operator can then not only assure himself of the safe temperature of the machine at any moment but he also is able to judge how much load can safely be carried by the machine at any time without exceeding the proper temperature limits. As regards protection from insulation damage due to surge over-voltage, all that can be done is to employ suitable static surge protectors of the lightning arrester types.

After a generator has long been in service, even if it shows no obvious sign of insulation weakness, it may be good policy to overhaul it carefully, at some period when it can safely be spared for a month, if need be. Inspection of one coil may afford a good indication.

Army Development of Charging Sets

Absolute Reliability, Portability and Ruggedness Were the Chief Requirements of Charging Sets for Army Radio Batteries Developed by Engineers of Signal Corps—Starting with Farm-Lighting Sets in Commercial Use Excellent Results Were Attained

BY CAPT. A. E. FLOWERS
Signal Corps, United States Army

THE experience of the army with radio communication in the field prior to the recent conflict included only the use of fairly powerful sets in small numbers, but with our entrance into the war in Europe an entirely new program was initiated. Instead of a few large radio sets, it was found necessary to use a large number of comparatively low-power and very portable equipments, since they were carried practically to the front-line trenches and the only means of transport was on the backs of soldiers. Previous sets had been supplied with electrical energy from generators driven by gasoline engines or by hand, but the new practice depended almost entirely on the use of portable storage batteries. Providing suitable charging equipment for these batteries was one of the problems presented to the Radio Development Section of the Signal Corps. The progress from a 1¼-kw. set, weighing 393 lb. (178 kg.), to a 1½-kw. set, weighing 150 lb. (68 kg.), is particularly gratifying and proves the value of industrial research even under war-time conditions. It is worth noting that the total cost to the Signal Corps for the engineering development work and making of samples for the development here recorded was 1.7 per cent of the cost of the sets ordered.

General Requirements

The charging sets were generally located at division headquarters and were subject to shell fire and to quick moving of station. Naturally, the only primary source

FIG. 1—A BATTERY-CHARGING POST IN FRANCE

of power to be considered was the gasoline engine, and the "farm-lighting set," well established in commercial production by a number of firms, was the starting point of the development. The service conditions are always extremely severe for military equipment, and this was no exception. It was recognized therefore that the order of importance of the various fundamental requirements for these sets was approximately this: (1) Reliability, (2) ruggedness, (3) portability, (4) simplicity in operation, (5) lightness, (6) economy in fuel and oil consumption.

It is significant of the purely military character of the development that low price is omitted from the list of requirements. The power ratings of the charging sets were determined, of course, by the number of

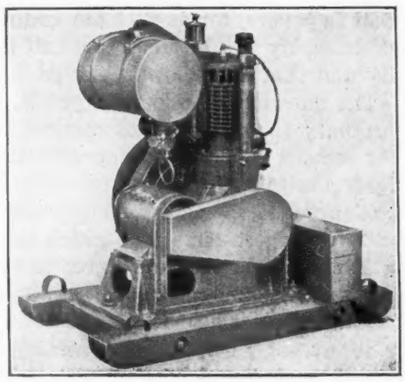


FIG. 2—FIRST CHARGING SET DEVELOPED BY SIGNAL CORPS
Rating, 1¼ kw.; engine speed, 800 r.p.m.; weight, 393 lb.; type, SCR 66. Note high center of gravity.

batteries to be charged on a basis of approximately ten hours per day operation; for the average division it was considered advisable to provide sets of 1½-kw. normal rating. It is interesting to note that this is approximately twice the capacity of the sets in use just prior to our entrance into the war, and the increase is an indication of the increasing part played by radio communication in the front-line operations.

The voltage requirements originally specified were based on the use of two general classes of batteries, one having a very low current and comparatively high voltage, and the other low voltage and high current. The generators were in consequence designed to have double commutators, one to supply current at 115 volts and the other at 25 volts. Later the use of the high-voltage batteries was discontinued and the generator was modified to be a single-commutator machine with output at 50 volts. The demand for sets for immediate use was so great, however, that, pending the production of sets to give these special voltages, standard 32-volt sets were adopted and, after being slightly modified as described later, were shipped overseas in limited numbers as an emergency supply.

The necessary charging panels were desired as separate units rather than permanently attached to the generator so that the panel could be mounted inside the building, leaving the set outside. In use, the set was carried to a new location by motor truck, removed by hand and set down in any available location. It was supposed to run under practically any conditions and received no special care. Fig. 1 shows the interior of a

battery-charging station in France, the generator being mounted outside the building.

It cannot be too strongly emphasized that for army use certainty of operation is the supreme factor. A machine must work and must work under any and all conditions. No complicated mechanisms are allowable, no matter how beautiful to look at, if they require "nursing" or must be handled gingerly for fear of spoiling a nice adjustment. Consequently, a test for army equipment takes on the characteristics of a "knock-down-and-drag-out fight." "Brute" tests that rack every part in ways no ordinary machine is supposed to undergo must be resorted to. It is essential to secure reliability in operation and ruggedness and then to do as well as possible with the remaining characteristics.

How the Development Was Carried Out

As with all other military developments in war time, speed was of prime importance and pressure of all kinds was brought to complete the development work and get the sets into production. To meet this situation permission was granted to waive some of the detail requirements for the first shipment.

A very large number of battery-charging sets have been manufactured in the United States during the past few years, probably several hundred thousand. These were designed mainly to suit the commercial conditions for farm lighting or other small isolated service. Heavy weight was no particular disadvantage, and low first cost was a prime consideration in order to find a market. Under these circumstances most of these sets had a rating of ¾ kw. at 32 volts and were sold for about $300. Some were fairly reliable and rugged, but instruction to a buyer was easy, and in any case repair parts were readily obtainable and a short shut-down was not a vital matter. These sets weighed 300 lb. to 500 lb. (135 kg. to 225 kg.) each. The first task of the Radio Development Section was naturally the collection of all available information on such sets. It is an interesting commentary on the magnitude of the industry that the preliminary survey considered the products of twenty-nine different companies.

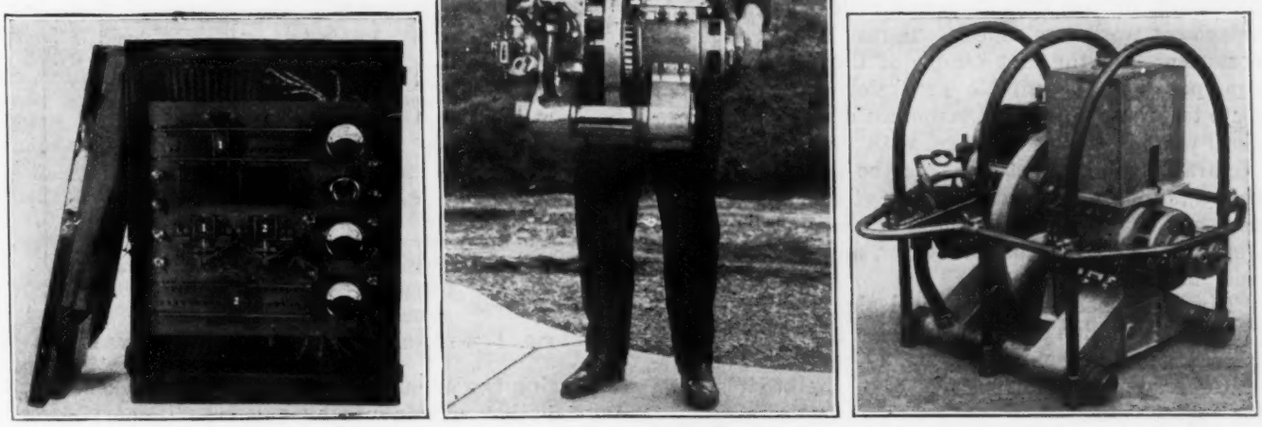


FIG. 3—LATER DESIGNS OF CHARGING SETS AND PANEL

(A) Final model illustrating portability—Type SCR 110-4. (B) Weight of this 1½-kw. set, 150 lb. (C) Door removed from carrying case, showing arrangement for safety of operator and protection of equipment—Type BD-8

It was evident from a preliminary examination that air-cooled engines would be lighter and more compact than those having water cooling and would avoid the necessity for constant attention to the water-cooling system, especially in cold weather. It was also considered that the requirements for reliability demanded the four-stroke-cycle type of engine and magneto ignition. With these points settled the balancing of immediate production against other desirable characteristics was undertaken and the development naturally divided itself into three stages as follows: (1) Production of commercial sets immediately available with such minor modifications as seemed absolutely necessary; (2) development of new sets generally similar to those in commercial use; (3) development of entirely new designs to include all desired characteristics.

The Use of Commercial Sets

The canvass of the available commercial sets already mentioned disclosed, of course, a very considerable number of sets on the market, but when the search was narrowed by the preliminary decision to use only four-stroke-cycle air-cooled engines with high-tension magneto ignition, it was found that only the sets indicated in Table I were available.

It will be seen that only two of these sets have a rating above 1 kw., and the extreme rating is only 1¼ kw., whereas the desired rating was 1½ kw.; but this sacrifice was made for the sake of immediate production. All four of these sets were given very severe tests, including twenty-four-hour non-stop runs, tests on increasing load until the engine stalled, drop tests for ruggedness, etc. Weaknesses developed by these tests such as oil losses at breathers, poor lubrication of main bearings, weakness of base, etc., were corrected, if possible, and a reasonable number of sets were ordered, the final form being that shown in Fig. 2 and designated as type SCR-66.

This slightly modified commercial set consists of a vertical single-cylinder, four-stroke-cycle gasoline engine, connected by an inclosed sprocket chain to a 1¼-kw., 32-volt, shunt-wound generator. The common base of the engine and generator is mounted on a skid for

easy handling. The engine speed is 800 r.p.m. and the generator speed 1900 r.p.m.

Cooling is by an integrally built fan in the flywheel, this fan being arranged to blow the air over the engine cylinder. A speed-regulating governor of the throttling type is also carried by the flywheel. Lubrication is by the splash system from the crank case, which in turn is supplied from a sight-feed lubricator. Ignition is furnished by a high-tension magneto. A tool box is provided to carry the necessary tools and spare parts for the charging set.

TABLE I—COMMERCIAL AIR-COOLED ENGINES, FOUR-STROKE-CYCLE, IGNITION BY HIGH-TENSION MAGNETO; GENERATOR 32 VOLTS; SHUNT-WOUND

Set No.	1	2	3	4
Number of cylinders	4	1	1	2
Engine speed	1000	800	1000	2000
Type of governor	Mechanical	Mechanical	Electrical	Electrical
Method of driving generator	Gears	Chain	Direct	Direct
Generator speed, r.p.m.	2500	1900	1000	2000
Output of generator, kw.	1¼	1¼	¾	¾ to 1
Floor space of set, inches	27 by 34	18 by 24	20 by 24½	18 by 44
Height of set, inches	29	29½	30	20
Weight of set without fuel (switchboard not included), lb	450	275	305	270

The over-all dimensions of the set are 41¾ in. long by 22 in. wide by 29½ in. high (106 cm. by 55.8 cm. by 74.9 cm.) The weight is 393 lb. (178 kg.) The engine is built by the New Way Motor Company and the generator by the Dyneto Electric Corporation.

Development Along Standard Lines

With this set in production attention was directed to obtaining sets having more nearly the desired characteristics. However, it was decided to retain the single-cylinder construction, as it was used in practically all the farm-lighting sets and in consequence could be produced with more assurance of success. An indication of the high pressure under which the development work was carried out may be had from the statement that the first sample of the new gas engine equipped with a suitable generator ready for complete tests was finished in seventeen days after the proposal was informally discussed with the manufacturers. Naturally, this did not complete the development since the tests indicated the desirability of changes in governors and modifications in various other parts. These were made very promptly, however, and the new design was put into production.

This set consists of a vertical single-cylinder four-stroke-cycle engine directly connected to a 2-kw. double-voltage generator operating at 1200 r.p.m. The generator is supported independently of the bed plate, on the engine frame.

A flywheel fan forces the required cooling air into the sheet-metal jacket surrounding the cylinder. Lubrication is by the splash system from the crank case, a gear-driven pump being employed for circulating the oil. Ignition is by a high-tension magneto. In order to facilitate rapid manipulation, a convenient drawer is provided in the wooden-skid base for holding the necessary tools and spare parts of the set.

The generator output is at 25 volts and 115 volts, thus providing for the charging of the two general classes of batteries mentioned above *i.e.*, low-voltage, high-current, and high-voltage, low-current. The over-all dimensions of the set are 44 in. (110 cm.) long, 21 in. (53 cm.) wide and 37 in. (94 cm.) high. The weight is 413 lb. (187 kg.). The engine is manufactured by the H. H. Franklin Manufacturing Company and the generator by the Dyneto Electric Corporation.

Other models of this set were arranged with 32-volt and 50-volt generators instead of the double-voltage machine described above.

The first production order of these sets had not been completed when a radical increase in the army program was made, and in consequence demand for immediate production of charging sets in much larger quantities was received. An examination of the plant capacity in which the sets just described were being made indicated that it could not meet the demand, and another firm was asked to produce sets of practically the same form, with as many of its own standard parts as possible. This design was available for production when the armistice was signed, but was not ordered in quantity.

Development of Entirely New Sets

The sets indicated in the preceding section had ample power output and were in many ways an improvement over the first sets produced, but they still lacked some of the desirable qualities. In particular their weight was excessive and they were too top-heavy for satisfactory handling in transportation. This high center of gravity was a fundamental objection in the single-cylinder design, and the development of entirely new sets using two or more cylinders was undertaken. Certain foreign sets in use by our expeditionary forces showed that much might be done with "two-cylinder opposed" construction, the set in question having an output of ¾ kw. and weighing 207 lb. (94 kg.). By this time the final requirements were well established and were stated as follows:

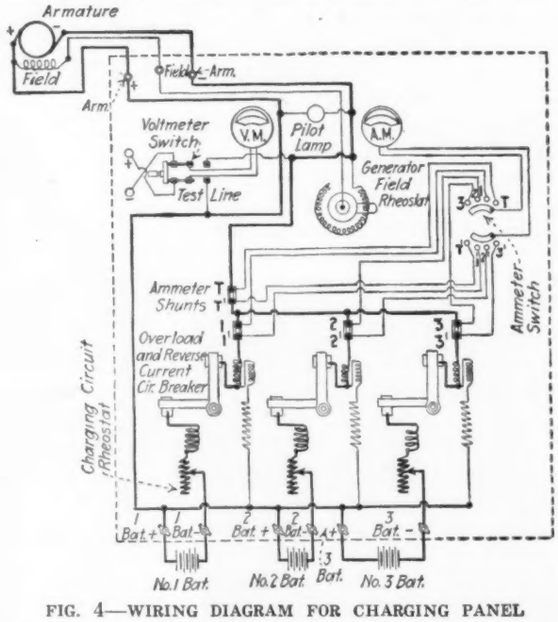


FIG. 4—WIRING DIAGRAM FOR CHARGING PANEL

ASSEMBLY:

(a) *Weight.*—Weight not to exceed 350 lb. (160 kg.), including spare parts, tools, gas and oil.

(b) *Mounting.*—Engine and generator direct-connected and mounted on same base.

(c) *Stability.*—Very stable, broad-skid base, low center of gravity, requiring no concrete foundation.

(d) *Portability.*—Portable, provided with suitable carrying handles.

(e) *Compactness.*—Compact as possible, other characteristics considered.

(f) *Air-Cooled.*—Cooled by fan mounted between engine and generator; fan may be integral part of the flywheel.

(g) *Weatherproof.*—Must operate satisfactorily when exposed to damp and cold weather.

(h) *Framework Protection.*—Pipe protection required, rugged and light.

(i) *Endurance.*—Every part as durable as possible.

(j) *Reliability.*—Must start easily regardless of weather conditions and must be capable of continuous operation from ten to twenty-four hours per day.

(k) *Simplicity.*—As simple in construction and easy to operate as possible.

(l) *Lubrication.*—Ample, positive, simple, reliable and economical of lubricant.

(m) *Vibration.*—The set must not have excessive vibration but must be smooth-running.

(n) *Speed.*—1800 r.p.m. maximum; 1500 r.p.m. or less preferable. Speed regulation not more than 10 per cent of full load speed.

(o) *Loose Parts.*—Loose parts should be few in number and where required should be secured to set by chains.

(p) *Locks and Keys.*—Two keys required for each lock. Keys for all sets identical.

(q) *Spare Parts and Tools.*—A full set of spare parts to replace parts which are most likely to wear out, together with a complete set of such tools as are necessary, shall be provided, packed in a suitable container. A list of such spare parts and tools shall be attached permanently to the container.

(r) *Instructions.*—Instructions complete and concise for operating the set, and in permanent form, shall be attached to the set in a suitable location.

(s) *Name Plates.*—Name plates shall be provided as prescribed by the Signal Corps.

(t) *Paint.*—Each set shall be given two coats of preservative paint, the top coat of which shall be standard olive-drab color.

(u) *Tests.*—Continuous full load for ten hours, then 25 per cent overload for two hours.

[Note.—This specification of 25 per cent overload rating is made for the following reasons: (a) A. E. F. requirements are for extreme reliability of performance. A set very closely rated has no factor of safety. (b) Standard practice on direct-current generators of this size calls for 25 per cent overload for two hours. (c) An allowance is desirable for decrease in rating due to wear and lack of adjustment on the parts of the engine. Gasoline engines are ordinarily very closely rated, and this overload requirement is considered necessary in order to insure full load rating over the life of the set. (d) Manufacturers have stated they could develop sets to meet this requirement within the weight limits specified by the A. E. F.]

ENGINES:

(a) *Cylinders.*—At least two cylinders. Two horizontally opposed cylinders preferred.

(b) *Capacity.*—The engine capacity should be sufficient for the prescribed capacity of the generator.

(c) *Ignition.*—Magneto ignition required. Must be thoroughly reliable.

(d) *Carburetor.*—Gravity feed preferred. Must be thoroughly reliable.

(e) *Starting.*—Equipped for hand cranking. Must be easy to start in cold or damp weather.

(f) *Fuel Consumption.*—The fuel consumption should not exceed 2 lb. per kilowatt-hour.

(g) *Drain Cocks.*—One-half-inch (1.27-cm.) oil cocks must be provided in bottom of crank case.

(h) *Oil Cocks.*—Two ¼-in. (6.3-mm.) oil cocks must be provided in the crank case to show the required depths of oil.

(i) *Breather.*—A suitable breather must be provided in the crank case. This must not chatter or permit oil to escape.

GENERATOR:

(a) *Capacity.*—1½ kw. with 25 per cent overload capacity for two hours; 50 volts direct current. Tested according to A. I. E. E. Standardization Rules. Shunt-wound, suitable for battery charging.

Four firms undertook to develop sets to meet these requirements, and Table II shows the results, the designers being, respectively, the Copley Manufacturing Company, the Mayhew Company, the Domestic Engineering Company and J. L. Yarian (Figs. 3B and 3C). The characteristics of these sets are shown in Table II.

These sets were completed after the armistice and were not produced in quantity, but if the war had continued one or more of them would undoubtedly have been produced in large numbers.

CHARGING PANELS

In addition to the engine-generator sets, it was of course necessary to provide control equipment. The batteries to be charged were in units of 4, 6, 10 and a few of 40 volts; the normal charging rate varied from 30 amp. to 3 amp., and the design had to be flexible, "foolproof" and of the lightest weight consistent with reliability.

TABLE II—AIR-COOLED ENGINES, FOUR-STROKE-CYCLE, IGNITION BY HIGH-TENSION MAGNETO, GENERATOR 50 VOLTS

Set No.	110-1	110-2	110-3	110-4
Number of cylinders	2	4	2	2
Engine speed	1300	1600	1500	1800
Type of governor	Mechanical	Mechanical	Mechanical	Mechanical
Method of driving generator	Direct	Direct	Direct	Direct
Output of generator, kw	1½	1½	1½	1½
Floor space of set, inches	44 by 29	40½ by 18	26 by 26	27 by 28
Height of set, in	29½	29½	28	21
Weight of set, without fuel, lb.	365	335	291	150

After a considerable discussion it was decided to provide two or three independent charging circuits in parallel and to have each capable of handling anything from one of the smallest batteries to the maximum number of the largest ones. It would thus be impossible to burn out the rheostats and possible to adjust any combination to the right charging current.

The building of light and yet rugged charging rheostats for use on the panels was not so easy as one might think. Thus, the panel supplied with the first 1½-kw., 32-volt set weighed 131 lb. (59 kg.), including rheostats for three charging circuits but not including any carrying case. The latest panel developed for the 1½-kw., 50-volt set weighs but 35 lb. (16 kg.), including control resistors for two charging circuits and a metal carrying case. The circuit diagram of these panels, as shown in Fig. 4, was laid out to provide the essential equipment with as little weight as possible. Circuit breakers were made to serve also as switches and change-over switches were provided for the meters.

The first panels were of open construction for wall mounting. Later ones, indicated in Fig. 3C, were of inclosed construction, the case being something like a sheet-metal suitcase. It can be operated on wall, floor or practically anywhere and is entirely self-housing. The design shown is for 40 amp., weighs 35 lb. (16 kg.) and is used for charging sets SCR 110-1, 110-2. 110-3 and 110-4.

The panels for the double-current generators were of the same general design but of only two circuits, separate panels being provided for the high-voltage and low-voltage sides.

It is worthy of note that within a few months American designers had developed entirely new sets having twice the rating and only 72 per cent of the weight of their nearest foreign competitor with a set much

more rugged and serviceable. This fact amply justifies the direct engineering attack of the fundamental problem rather than the attempt to copy available material already in service. The essence of military strategy is superiority. Napoleon's dictum that "God fights on the side having the heaviest guns" may or may not be true so far as the Deity is concerned, but it is the soundest of policies in the supply of equipment to an army. It is fatal for a military commander or a country to drift into an attitude demanding and exacting anything other than the superlatively best in every part of its fighting equipment, and this superiority in technical equipment is only a matter of enough brains on the job. The quality of American engineering is easily equal to that of any competitor, but short-sighted management often fails to get the desired result by the use of too few engineers and of those few under conditions making first-quality output impossible.

It is of course understood that the sets resulting from the development here discussed are not perfect. Further service experience and more time spent on detail design will undoubtedly lead to still further improvements. The story is told in the hope that it may contribute to such future progress.

Reinsulation of Large Generators

To Provide Against Interrupted Service on Its Lines During the Period of Heavy Winter Peak Loads, Milwaukee Company Follows This Practice—Engineering Experience Gained in Handling Four Machines Totaling 43,000 Kw.

DURING the load valley of the spring, summer and early fall of 1918 the Milwaukee Electric Railway & Light Company reinsulated the generator windings on four of its main machines as a precautionary measure. While this is not an entirely new practice among the large central-station companies, it is a division of plant operation to which not much attention has been given. The idea has come more to the forefront during the last few years since central-station companies have not been able to maintain their usual percentage of machine reserves. Because the lack of reserve generator capacity may grow worse in some central stations, and because continuity of service during the coming two years should be jealously safeguarded to keep the good will which central-station electric service has gained during the war, the topic merits the closest attention.

The situation surrounding this work at Milwaukee can be better appreciated, perhaps, if some facts are first given concerning the loads the company was carrying and concerning the generator rating that was available. The total rating of the company's generators at its stations both in Milwaukee and in the surrounding territory is 92,000 kw. To this about 12,000 kw. of purchased hydroelectric energy is added at certain times.

The approximate maximum demands which the company was called upon to care for are tabulated here:

February	69,000
March	63,500
April	59,000
May	61,500
June	65,000
July	67,000
August	65,000
September	66,500
October	66,000
November	88,000

Of the 92,000-kw. generator rating possessed by the company, 73,750 kw. is in plants in Milwaukee. Since 43,000 kw. in four machines was reinsulated, it may be seen that 58 per cent of the machine capacity in Milwaukee and 46.5 per cent of the company's total generator capacity was reinsulated. From these data it may also be noted that the failure of any important unit during the period when one of the machines was down for reinsulation would have been serious. It also shows why the company was willing to spend a large sum of money to prevent possible future trouble.

The generators reinsulated included two 7500-kw., 6600-volt, three-phase, 750-r.p.m., 25-cycle generators connected to vertical low-pressure turbines and two 14,000-kw., 4000-volt, 720-r.p.m., three-phase, 60-cycle machines connected to vertical high-pressure turbines. All of the machines were of General Electric manufacture. The two 7500-kw. machines were duplicates and were known by the Milwaukee company as Nos. 9 and 10. The larger machines were also duplicates, and they were known as Nos. 11 and 12. The working period for the four machines began on Feb. 14, just after the No. 10 machine had burned out, and lasted until Sept. 14. The time was divided among the four machines as follows:

Machine	Dates	Time Elapsed
No. 10	Feb. 14 to April 10	55 days
No. 9	April 22 to June 4	45 days
No. 11	July 6 to Aug. 6	30 days
No. 12	Aug. 15 to Sept. 14	29 days

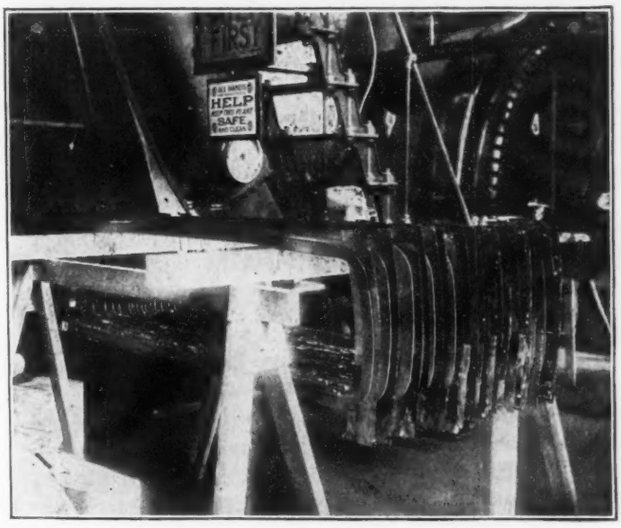
It will be observed that there was a considerable reduction in the length of time required to do this work as more experience was gained. This statement of time required is to some extent misleading, however, because on the machines Nos. 11 and 12 only the fields were reinsulated, while on Nos. 9 and 10 the windings of the entire machines were handled. It is a fact, nevertheless, that it was possible to reduce the time required. The principal factor in effecting this reduction was the employment of a definite schedule of work. A schedule was worked out by the electrical engineer of the Milwaukee company and was agreed to by the foreman who was acting for the General Electric Company. In the work on the last three machines these schedules were adhered to almost to the day. Working to a schedule on the first machine was hardly possible because it was damaged somewhat by the burn-out and material was difficult to obtain. Some of the armature coils were burned so that they had to be ground in order to make them "take" the solder. Moreover, special shop equipment such as horses to support the coils and tanks for boiling the coils had to be constructed. Special tools were also required for handling the coils. These consisted mostly of chisels and wedge drivers and were

made on the job. Because of the heavy duty to which they were subjected, owing to the character of the work, many were broken before just the correct degree of temper was attained. The forms and clamps for shaping the refinished coils came from the factory. All this work was done in the shops of the company.

Copies of the schedules of work on a 7500-kw. and a 14,000-kw. machine are published here to show how the work was managed and to show what work was done. It should be noted that not as many unskilled workmen as the schedule provided for were available. Nevertheless, the work was handled with the men who could be secured.

Surges Puncture Insulation Between Turns

Both of the 7500-kw. machines had been installed new at Milwaukee in 1911 and had operated continuously without insulation breakdowns since that time. However, when the condition of the insulation of the first machine was seen as it was disassembled it became apparent that it would be wise to consider taking down the other machines before trouble occurred in them. The fish-paper insulation, which was 9 mils or 10 mils thick, had become brittle. Surges had actually caused fine punctures between turns. On opening the second 7500-kw. machine it was found that the fear for its



PREPALING FIELD WINDING FOR NEW INSULATION

condition was well founded. Many bad spots in the insulation of the field winding were uncovered.

With the 14,000-kw. units the situation was somewhat different because the armatures had recently been rewound. Moreover, the insulation appeared to be pliable and withstood the high-potential test. Some doubt was felt as to the condition of the field windings, however, so they were reinsulated. A few bad spots were found in the field windings of each of these machines.

How the Coils Were Handled

Some of the details concerning methods of doing the actual coil repairing are interesting, and there are a few points of experience which might be helpful to other central-station companies undertaking similar work. When the coils had been taken out of the machine the turns were separated by driving blocks of wood between them. Then they were placed in a bath of soda ash to make the old insulation come off readily. The tank used for this purpose measured 8 ft. (2.4 m.) wide by 12 ft. (3.6 m.) long by 2.5 ft. (0.8 m.) high. It was heated by live steam admitted through three taps. About 1200 lb. (544 kg.) of soda ash was used for the coils of each machine. In each case one-half the coils were boiled at a time, so that 600 lb. (272 kg.) of soda ash was used each time a bath was made in the tank. Each batch was boiled for thirty-six hours.

When the insulation had been removed the coils were cleaned with emery paper and sandpaper. Burned spots were filled with silver solder. They were then ready to reinsulate and were hung on racks to facilitate that work. A pasty shellac varnish was applied to the copper and over this a layer of asbestos and mica tape 12 mils thick was laid. When this sort of insulation had been applied the coil was placed on a form, clamped down and baked by sending a heavy current through the copper. For this purpose it was necessary to have a source of direct current available. For such machines a supply capable of maintaining 800 amp. for one hour to two hours, depending on the size of the coil, is necessary. Alternating current cannot be used because the forms on which the coils are placed for shaping are of iron and the high impedance of the resulting circuit prevents enough current from flowing to give the required heating effect. This current causes the coil to "cement," which is the term used in describing the action of the insulating varnishes and the insulating materials.

When the coil has cemented and cooled, the edges are scraped and cleaned with sandpaper and the coil can be tested for insulation between turns with alternating current. The terminals of the coil are then affixed to new connecting strips, and the coil is ready for its over-all insulation. This consists of a layer of linen tape 5 mils thick butted and treated with No. 211 compound, two layers of mica tape 5 mils thick, half lapped, inside the slots, and three outside, one layer of 15-mil asbestos tape half lapped and filled with No. 152 compound inside the slot and two layers outside the slots. Then the slot armor is applied. Especial care is used in handling the coils after they are formed.

Schedule for Repairing 7500-Kw. Generator No. 9

The schedule for repairing the 7500-kw. generator No. 9 at the Commerce Street station was prepared approximately as follows and was adhered to as closely as possible. All of the material required was on hand, and there were, therefore, no delays on this account:

A. April 22.....Dismantle machine.
B. April 23 to 26....Take off end plates from field, drive out brass wedges, remove laminations and send field coils to the Cold Spring shops. This work will be done on a day-and-night basis with six men in each shift.
C. April 23 to 26.....Drive out armature wedges, unsolder and remove coils and send to the Cold Spring shops. This work is to be done on a day basis only and will require at least eight men.
D. April 27 to May 11.Clean armature core, reinsulate lacing rings, clean field core, put on plate insulation, tape field bolts with asbestos, clean clips, etc. This work is to be done on a day basis and will require at least eight men.

E. April 27 to 30.... Block and boil field coils at Cold Spring. This work is to be done on a day basis with overtime if necessary and will require eleven men.

F. April 29 to May 4 Clean field coils and prepare same for turn insulation. This work will be done on a day basis and will require fifty men.

G. May 1 to May 8.. Repair defects in field coils, put on turn insulation and trim insulation. This work will be done on a day basis and will require sixteen men.

H. May 6 to 12..... Form work on field coils. This work will be done on a day basis and will require nine men.

I. May 7 to 13..... Sand field coils and attach field leads. This work will be done on a day basis and will require seven men.

J. May 9 to 16..... Tape field leads and field coils. This work will be done on a day basis and will require nine men.

K. May 11 to 17..... Put slot armor on field coils and bake same. This work will be done on a day basis and will require six men.

L. May 16 to June 5. Reassemble field at Commerce Street. This work will be done on a day basis and will require five men. This part of the schedule, however, will be subject to change, as it may prove advantageous to work day and night.

M. April 27 to May 12 Tin ends of armature coils, remove old insulation (outer tape only), reinsulate, apply slot armor and bake coils. This work will be done on a day basis and will require five men.

N. May 3 to June 1. Attach space blocks to armature coils, heat coils and install same. This work will be done on a day basis and will require fourteen men.

O. June 6..... Assemble machine.

P. June 7 and 8..... Run on short circuit to dry out.

The men required for carrying out the above schedule will be divided into two main groups, (a) skilled men, (b) unskilled men.

Date	Skilled Men	Unskilled Men	Date	Skilled Men	Unskilled Men
April 23 and 26...	8	12	May 11 and 12...	24	34
April 27 and 28...	8	17	May 13.....	18	18
April 29 and 30...	8	67	May 14 and 15...	17	12
May 1 and 2...	11	69	May 16.....	19	15
May 3 and 6...	13	81	May 17 to 31....	10	15
May 7 and 8...	14	45	June 1 to 5....	5	0
May 9 and 10...	19	34			

SCHEDULE FOR REPAIRING 14,000-KW. GENERATOR NO. 12

The schedule for repairing the 14,000-kw. generator No. 12 at the Commerce Street station has been prepared and is as follows. It is to be adhered to as closely as possible. All of the material required is on hand and there should therefore be no delay due to shortage of material.

A. Aug. 15..... Dismantle machine.

B. Aug. 16–19 (inclusive).... Take off end plates from field, drive out brass wedges, remove laminations and send field coils to the Cold Spring shops. This work will be done on a day-and-night basis with six men in each shift.

C. Aug. 16–25..... Clean armature, clean field core, put on plate insulation, tape field bolts. This work will be done on a day basis and will require three men.

D. Aug. 19–20..... Block and boil field coils at Cold Spring. This work is to be done on a day basis with overtime if necessary and will require eleven men.

E. Aug. 20–24..... Clean field coils and prepare same for turn insulation. This work will be done on a day basis and will require thirty men.

F. Aug. 21–25..... Repair defects in field coils, put on turn insulation and trim insulation. This work will be done on a day basis and will require nine men.

G. Aug. 24–30..... Do form work on coils. This work will be done on a day basis and will require nine men.

H. Aug. 25–31..... Sand field coils and attach field leads. This work will be done on a day basis and will require seven men.

I. Aug. 26 to Sept. 1 Tape field leads and field coils. This work will be done on a day basis and will require nine men.

J. Aug. 28 to Sept. 3 Put slot armor on field coils. This work will be done on a day basis and will require six men.

K. Sept. 2 to Sept. 11 Reassemble the field at Commerce Street. This work will be done on a day-and-night basis and will require five men in each shift.

L. Sept. 12–13..... Bake and paint field.

M. Sept. 14..... Reassemble machine.

This work was planned and carried out under the supervision of G. G. Post, electrical engineer of the Milwaukee Electric Railway & Light Company.

BENEFITS DERIVED FROM INDUSTRIAL TRAINING

Results Attained from Establishment of Such a Department in War Time Have Led to Its Permanent Institution by Large Plant

The superintendent of one of the country's large manufacturing plants has given emphatic testimony regarding the benefits of industrial training in a recent bulletin issued by the United States Training Service of the Department of Labor. The pamphlet is "A Business Man's Experience with Industrial Training." E. A. Barnes, superintendent of the General Electric Company plant at Fort Wayne, Ind., is the author. Mr. Barnes believes that industrial training as promoted by the training service should be generally adopted in American industries. "In too many cases," he says, "the old system of letting shop foremen hire men without much consideration for the applicant's ability or training is still in effect, with the result that many new employees spoil work, ruin expensive machinery and tools and really produce little work that is perfect enough to be shipped." Mr. Barnes goes on to tell of his conversion to the permanent value of training. He found that his foremen were especially anxious to secure the workers who had been through the training department, which fact of itself was strong indorsement of the idea. Experience with what was first considered a temporary feature led to making it permanent. To this training department all new employees are sent and also old employees who from lack of proper training are not doing as well as they might.

Selecting Equipment for Industrial Lighting—I

Complete Statement of the Requirements of Good Illumination—Problems of Correct Illumination, Color and Elimination of Objectionable Glare—Technical Data Concerning Lamps Are Also Included

BY WARD HARRISON AND H. H. MAGDSICK
National Lamp Works of the General Electric Company, Cleveland

THE ideal source of illumination for factory use must be low in brilliancy to minimize glare and specular reflection and must distribute the light in a manner to supply satisfactory illumination on the vertical as well as on the horizontal plane. It must be sufficiently large in area to give soft shadows and in most

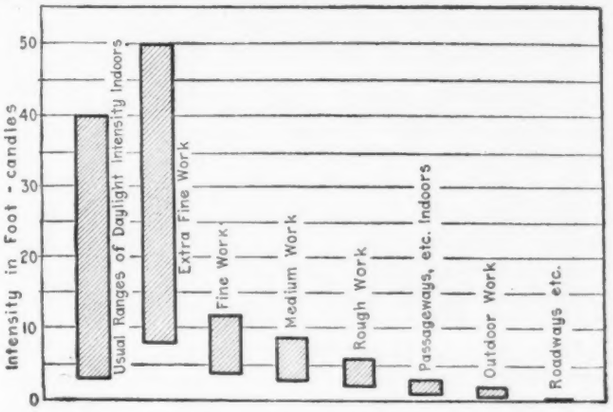


FIG. 1—ARTIFICIAL LIGHTING INTENSITIES COMPARED TO INTERIOR DAYLIGHT VALUES

cases must be small enough to secure a directed light. Reflecting and diffusing equipments of many characteristics for the production, with modern incandescent lamps, of some or all of these qualities in any degree required are available.

REQUIREMENTS OF GOOD ILLUMINATION

The requirements which must be met in the choice of equipment and in the design of a satisfactory lighting installation for industrial plants are:

(1) A steady light of sufficient intensity on all working surfaces, whether in horizontal, vertical or oblique planes.

(2) A comparable intensity of light on ajacent areas and on the walls.

(3) Light of a color and spectral character suited to the purpose for which it is employed.

(4) Freedom from glare and from glaring reflections.

(5) Light so directed and diffused as to avoid objectionable shadows or contrasts of intensity.

(6) A system which is simple, reliable, easy of maintenance and reasonable in initial and operating cost.

To-day work of every kind, including the most intricate operations and those requiring the utmost precision, must be carried on throughout the twenty-four hours. Obviously the minimum intensity to be supplied is that which will permit comfortable vision, conserve eyesight and eliminate accident hazard. Many states, through their industrial commissions, are beginning to require the employer to make such minimum provision. However, the govermental requirements are not such as to assure the most economical production, a factor of vital interest to the manufacturer, and to obtain this considerably higher intensity values are found necessary.

It is difficult to recommend the exact intensity required in a given plant from the economic standpoint. This figure necessarily depends upon numerous factors, such as the cost of producing light, the number and wages of the employees and the value of their output, all of which vary widely in different establishments. For good vision the color and fineness of the materials worked upon are important considerations in determining the amount of light which should be supplied. An object is seen by the light which it reflects rather than by the light falling upon it; hence textile industries manufacturing dark-colored fabrics require higher intensities than those mills which produce light-colored goods. Manufacturing processes involving fine machine work or fine assembling require more light than industries where a comparatively low degree of accuracy suffices. The greater, alertness and better morale of the workmen in brightly lighted surroundings is at once reflected in the greater production of the plant.

In consideration of the amount of light necessary for factory illumination the criterion must be the intensity on all working surfaces. Except in especially unfavorable locations, such as near the dark side wall of

FIG. 2—AN INSTALLATION OF MIRRORED-GLASS REFLECTORS IN A FOUNDRY

a room, any of the systems of lighting usually employed can be expected to provide an intensity of illumination on any vertical plane equal to about one-half of that measured on a horizontal plane at the same point. This fact should be kept in mind, particularly in designing a lighting system to comply with the state codes, which usually specify only that value which must be provided on the principal plane of the work. The intensity values used in industrial lighting as compared with the usual range of daylight

intensities existing in factory interiors are shown graphically in Fig. 1.

Moderate intensities of illumination in aisles and other spaces intermediate between the working surfaces, on the walls, etc., are necessary for safety, good vision and stimulating atmosphere. Light side walls are conducive to a cheerful impression of brightness throughout the room. The eyes of the workmen looking up from his well-illuminated machine or bench

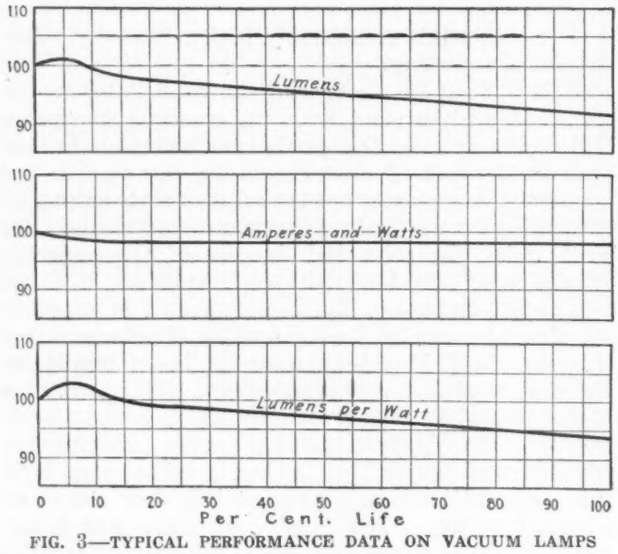


FIG. 3—TYPICAL PERFORMANCE DATA ON VACUUM LAMPS

are not adapted for vision at low intensities. Hence, if ajacent objects and aisles are only dimly lighted, he will be compelled either to grope about, losing time and risking accident, or to wait until his eyes have become adapted to the low intensity. Glancing back at his work, he again loses time while the pupils of his eyes adjust themselves to the increased amount of light which reaches them. If long-continued, this condition leads to fatigue as well as to interference with vision and to accidents. As daylight intensities represent the standards which are to be sought in the artificial lighting of industrial plants, so does the color of daylight constitute the standard which should be approached in artificial illumination. The so-called "daylight" lamp, with its specially selected blue-green glass bulb, gives a light which is a further step toward daylight color and extremely valuable in the manufacturing processes requiring closer color identification or better revelation of detail through color contrasts. For dye making and color matching where extreme accuracy is required, several equipments with special absorbing screens are available which duplicate the standard north sky light with exactness. Under certain conditions, on the other hand, as in a foundry, the criterion for the choice of an illuminant is the penetrating power of the light. The appearance of the sun through smoke, haze or fog evidences the fact that the shorter wave lengths, or the rays near the blue end of the spectrum, are absorbed or dispersed, while the longer wave lengths pass through. Hence, under such conditions, the light in which red and yellow predominate is most effective.

In guarding against the serious effects of glare, six principal factors should be taken into consideration:

(1) Total candlepower from the source directed toward the eye.

(2) Distance from the source to the eye.

(3) Intrinsic brilliancy of the source.

(4) Contrast in brightness between the light source and the working surfaces and surroundings.

(5) Proximity of the light source to the line of vision.

(6) The length of time during which the source of glare is present within the field of vision.

Glare is not entirely a question of the intrinsic brilliancy. Of greater importance than this is the question of the total light flux entering the eye. Tests have shown that a 10-in. (25-cm.) opal globe equipped with a 500-watt gas-filled lamp, hung approximately 10 ft. (3 m.) above the floor and 10 ft. from the observer, will prove fully as glaring as a 75-watt gas-filled lamp in the same location. Although the intrinsic brilliancy of the opal globe unit is only two or three times that of a candle flame, the total candlepower is so excessive that its effect is just as bad as that of the filament of the other gas-filled lamp, which has an intrinsic brilliancy 400 times as great as that of the globe. Glare caused by specular reflection from working surfaces is particularly trying because of the necessity of directing the eyes toward those surfaces, and further because the eyes by nature are especially sensitive to light entering from below. In choosing lighting equipment it must be borne in mind that, although a given reflector may afford adequate protection against direct glare from the lamp filament, it may not protect against glaring reflections unless the lamp is shielded.

Differences in brightness of surfaces, that is, light and shadow, are essential in observing objects in their three dimensions. On the other hand, in the factory it is usually necessary to work on surfaces in many planes; hence, while dense, sharp shadows would define edges and outlines most distinctly, they might be so dark as to interfere with work in the shaded areas.

FIG. 4—AN APPLICATION OF SEMI-INCLOSING UNITS IN INDUSTRIAL LIGHTING

Vacuum and gas-filled lamps are available in a wide range of sizes and in several voltage ranges to provide for every application. The curves of Fig. 3 show the changes in light output, energy consumption and efficiency of gas-filled lamps which occur throughout their rated life of 1000 hours. It will be noted from the curves that the current consumption decreases during the first 200 hours of burning. The decrease in lamp efficiency is therefore less throughout life than the de-

crease in light output. It will be noted that the final lamp efficiency is within 6 per cent of its initial value. The life rating of multiple lamps is determined by the average results of exhaustive tests on many groups of lamps. As an illustration of the results of a typical test on 100 60-watt vacuum lamps, the following table is given. It can be seen that out of the lot of 100 lamps forty lamps failed before burning 1000 hours and sixty lamps burned beyond that period. The average life of all lamps, however, is slightly in excess of 1000 hours:

FIG. 5—GENERAL LIGHTING BY ANGLE AND OVERHEAD UNITS

Hours burned.....	0	200	400	600	800	1000	1200	1400	1600	1800
No. lamps remaining	100	97	94	89	77	60	39	17	3	0

Incandescent lamps of the 110-volt to 125-volt class operate at a higher efficiency than those of the 220-volt to 250-volt class, although the rated life is the same, namely, 1000 hours, and the cost of the lower voltage lamp is materially less. Moreover, the service rendered by these lamps of the high-voltage class is somewhat inferior to that of the lower-voltage class. It is advisable in almost every case to utilize the lamps of the lower voltage range.

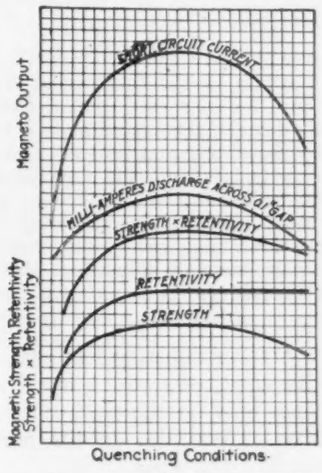
Lighting and power circuits should be separate. Not only are fluctuations and voltage caused by the starting of motors or by the sudden shifting of heavy loads thereby confined mainly to the power circuit but with this arrangement trouble in the power circuit is far less likely to cut off the illumination of the plant at a moment when light is urgently needed.

PERMANENT MAGNETS AND THEIR PROPER TREATMENT

The Two Things Upon Which Their Quality Depends—Nine Considerations in Their Manufacture Are Enumerated

Although a vast amount of scientific investigation has been done and a great deal has been written on the subject of permanent magnets, it remains one upon which very little practical useful information exists. Generally speaking, there are two things which are a measure of the quality of permanent magnets. These are: (1) the residual induction or residual magnetic influx; (2) the retentivity or coercive force. The object of the manufacturer is then to produce a magnet of good quality, of uniformity and permanence. These problems are discussed by John Walter Esterline in a recent booklet, "Permanent Magnets," published by the Esterline Company.

He states that all kinds of steel which can be tempered will retain a portion of the initial magnetism if magnetized. There are, however, very few kinds of steel which make relatively good permanent magnets,



TESTS OF PERMANENT MAGNETS

Curves determined by actual tests showing the relation between the quantities of permanent magnets and the output of magnetos using these magnets. The variation in quality was obtained by varying the quenching conditions, using the same chemical analysis. These curves show clearly the importance of magnets of the proper quality.

and the quality of the magnets made from any kind depends upon a great many different things: (1) Chemical content; (2) conditions under which the billets are made; (3) rolling conditions; (4) annealing; (5) furnace conditions and treatment during the forming or forging of the magnets; (6) conditions under which the final heat treatment is done; (7) the mechanical operations performed after final heat treatment; (8) the process of maturing; (9) method of magnetizing. It is suggested that for the majority of uses to which permanent magnets are applied the product of strength multiplied by retentivity is the best measure of magnetic quality. This has been demonstrated by tests, typical results of which are given in the figure.

The process of aging or maturing the magnets consists in subjecting them to a series of magnetizing and demagnetizing forces after quenching.

IT IS a notorious fact that very few cities and towns have the slightest conception as to what it costs them to build, operate and maintain a municipal utility plant. Possibly in some instances they don't care, but as a plain business proposition they should know whether it is being maintained partly from general revenue of the municipality. It is very natural, however, that city officials want to make as good a showing as possible and are only too willing to allow their successors to assume the burden of renewals to the property. The result is that in a few years not much value is left to the plant, for it is mostly junk.—*S. S. Kendall, Colorado Utilities Commission.*

The Need of Adequate Rates

Central Stations Must Face the Situation Boldly and Make Plans for Betterments Without Waiting for Decline in Commodity Prices—Their Case Rests on the Economic Changes of the Times

BY L. K. COMSTOCK
L. K. Comstock & Company

This was written by Mr. Comstock in answer to a series of questions sent to him by the ELECTRICAL WORLD. These centered on the need for increased central-station facilities to meet the public demand for power and on the ways and means of raising the great amounts of capital required. Mr. Comstock's view in brief is: (1) Central stations must expand, accepting commodity prices at the present level without waiting for a decline, and (2) they must tell the regulating commissions and the public boldly that the values in which they are paid have been depreciated and higher rates are necessary.

THE central-station industry has been and is confronted with conditions which merit serious consideration not only on the part of central-station owners and managers but also on the part of public service commissioners and consumers.

When central stations are faced on the one hand with increased costs of labor, apparatus, supplies and all things entering into the cost of energy output, and on the other hand with the rate regulations of service commissions, there results an unbalanced condition or lack of equilibrium, producing poor service, general dissatisfaction, small profits or deficits.

Past experience shows that the central-station industry, roughly speaking, has doubled its output and gross revenue every five years. This means large capital expenditures every year in order to provide generating and distribution facilities to meet normal increases. Increased cost of raising capital and higher interest rates must of necessity reflect themselves in the cost of energy output.

NO GENERAL DOWNWARD TREND IN PRICES

Much has been said and written about an impending fall in prices of metals, building materials and staple supplies to pre-war levels, but the downward trend has been notable in copper alone. Had not the close of the war found the government in possession of huge stocks of copper which have been unloaded upon a weak market, it is doubtful if the price would have sagged much from the price fixed by the War Industries Board last October. It is thought by many good judges that the trend of copper prices will be slowly upward when the buying and selling forces finally reach a post-war equilibrium.

The building construction industry, a good barometer of commercial and industrial prosperity, has about reached the conclusion that prices will not recede much, if any, and as a result building operations will go forward without much further waiting. This conclusion is sound because three powerful factors support it.

The first factor is to be found in inflation. Huge amounts of gold, paper money and credit money have been added to the world's supply, and this relatively depreciates the value of the dollar and inversely causes all prices to rise. The face value of the paper currency put out during the war is greater than the value of all the gold and silver mined in the world since the discovery of America. The legal-tender circulating medium of the world has increased from $15,000,000,000 in 1913 to more than $45,000,000,000 in 1918.

The second factor is to be found in the labor situation. Labor, not alone in America, but everywhere, has set its face against decreases in wages, and rightly so, because the purchasing power of the dollar, if reckoned at par in 1913, is but $0.5102 in 1918. Since all material costs represent nothing but accumulated labor, how can one reasonably expect generally lower material costs?

The third factor is the potential demand for every kind and description of materials.

Central stations must boldly face the situation and make their plans for the necessary and normal betterments and increases without waiting for the fatuous fall in prices. The public must be served and the public is willing to pay reasonably for service. Betterments and increases should be strictly limited to those which will generate and safely distribute the most kilowatts.

It is not possible for central stations to continue their capital expenditures for betterments and increases in a rising market and their operating expenditures at higher costs for labor and supplies and at the same time to be compelled by public service commissions to sell their output at a price fixed quite independently of the conditions brought about by the subtle operations of laws which need no human administrators.

It can be shown to those who are willing to learn that if a central station sold 1000 kw.-hr. in 1913 for $30 and if a public service commission regulation required the same money rate in 1919, the central station would actually receive in 1919, not $30, but about $15.31, if reckoned in purchasing power, because $30 based on a 1913 commodity valuation is equal to $15.31 in 1919 based on a commodity valuation.

If public service commissions could be made to appreciate the argument that all of the commodity expenditures of the central station made for present extensions and operations are on a 1919 commodity base, and the rate at which the central stations are permitted to sell their output are on a 1910 or 1915 or 1916 commodity base, and that it is only necessary to bring the two bases into harmony, much of the central-station manager's worry would be at an end.

It is not possible to suppose that radical alterations in the value of the units in which financial transactions are measured can be lived through without corresponding radical readjustments. These alterations in units of value continue to operate inexorably whether public service commissions recognize them or not, just as the earth continued to be round whether the contemporaries of Columbus believed it or not.

It should be clearly borne in mind that, except as

to profits paid out in dividends or carried to surplus account, the central-station business is simply one of buying and selling human energy, either physical or mental; and with this in mind it is difficult to escape the conclusion that the business of generating, distributing and selling electrical energy is one of the few industrial activities in which the charge for the unit sold bears little relation to the cost of production.

Central-station owners and managers should lose no time in preparing their cases from the economic point of view, using the index number as a guide to determine the value of the coin in which they are paid for the kilowatt-hour sold, in laying their cases before the commissions and if necessary before the public. Herein lies the true remedy for the distressing ills which have befallen the central-station industry.

A. I. E. E. COMMITTEE PROPOSES STANDARD RELAY NOMENCLATURE

Misunderstandings Among Operating Companies Due to Difference in Names for Protective Relays—Committee Draws Up Definitions

From the answers of thirty-two operating companies to a questionnaire sent out by the protective devices committee of the American Institute of Electrical Engineers it was apparent that much confusion existed in the use of names describing the various protective relays. The committee therefore undertook to select and propose for standard the following nomenclature:

Electric Protective Relay.—An intermediate device by means of which one circuit is indirectly controlled by a change in conditions in the same or other circuits. The relay is ordinarily equipped with contacts to open or close an auxiliary circuit.

Directional Relay.—Any relay which functions in conformance with direction of power or voltage or current or phase rotation, etc.

Power-Directional Relay.—Any relay which functions in conformance with direction of power. (Note: This includes both unidirectional relays with single-throw contacts and duodirectional relays with double-throw contacts. The reason this name is preferred to "reverse power" is that the device is frequently used to function under normal direction of power. Furthermore, in some cases the normal condition of the system may permit power to flow in either direction. Relays for use in either alternating or direct current circuits are to be classed as power-directional relays.)

Polarity-Directional Relay.—Any relay which functions by reason of a reversal of the normal direction of polarity.

Phase-Rotation Relay.—Any relay which functions by reason of a reversal of the normal direction of phase rotation.

Current Relay.—Any relay which functions at a predetermined value of the current. These may be either over-current relays or under-current relays.

Voltage Relay.—Any relay which functions at predetermined value of the voltage. These may be either over-voltage relays or under-voltage relays.

Watt Relay.—Any relay which functions at a predetermined value of the watts. These may be either over-watt relays or under-watt relays.

Frequency Relay.—Any relay which functions at a predetermined value of the frequency. These may be either over-frequency relays or under-frequency relays.

Temperature Relay.—Any relay which functions at a predetermined temperature in the apparatus protected.

Open-Phase Relay.—Any relay which functions by reason of the opening of one phase of a polyphase circuit.

Differential Relay.—Any relay which functions by reason of the difference between two quantities such as current or voltage, etc. (Note: This term includes relays heretofore known as "ratio balance relays," "biased" and "percentage differential relays.")

Locking Relay.—Any relay which renders some other relay or other device inoperative under predetermined values of current or voltage, etc.

Trip-Free Relay.—Any relay which prevents holding in an electrically operated device such as a circuit breaker while an abnormal condition exists on the circuit.

Auxiliary Relay.—Any relay which assists another relay in the performance of its function and which operates in response to the opening or closing of its operating circuit.

Signal Relay.—An auxiliary relay which operates an audible or a visible signal.

Qualifying Terms as Applied to Relays

Notching.—A qualifying term applied to any relay indicating that a number of separate impulses are required to complete operation.

Inverse Time.—A qualifying term applied to any relay indicating that there is purposely introduced a delayed action, which delay decreases as the operating force increases.

Definite Time.—A qualifying term applied to any relay indicating that there is purposely introduced a delayed action, which delay remains substantially constant regardless of the magnitude of the operating force. (For forces slightly above the minimum operating value the delay may be inverse.)

Instantaneous.—A qualifying term applied to any relay indicating that no delayed action is purposely introduced.

Where relays operate in response to changes in more than one condition, all functions should be mentioned.

ELECTRIC STEEL FURNACE RATE SITUATION IS UNCERTAIN

Foundrymen and Steel Manufacturers Claim Lower Rates Are Necessary and Annual Minimum Charge Is Suggested to Cover the Situation

Writing from the Middle West, a central-station power salesman said: "There seems to be a great difference of opinion as to whether or not the electric furnace will survive the high-rate period through which it is now passing. I have had correspondence with several central stations, some of which are about to bring out special rates for this class of service, which in my opinion opens up ground for criticism from the rate-making standpoint.

"Information from the steel manufacturers is to the effect that the steel makers who will use converters and other processes with oil furnaces will find that their manufacturing costs do not vary so greatly with the output as they do with electrical energy. Consequently these manufacturers, so they say, are able to name a lower price for their castings. especially in the dull periods. On the other hand, the electric furnace users are faced with a high energy cost during their periods of low output. This, of course, brings up the rate per kilowatt-hour and apparently increases their manufacturing costs. Consequently they feel they are unable to compete with other processes. This argument holds true in the steel castings industry only and does not apply to the manufacturers of alloy steel."

Another central-station sales manager in the Middle West has expressed his personal opinion that the solution of the problem lies in changing electric furnace rates by inserting an annual minimum charge below which the central-station company cannot go. This annual minimum charge, it is thought, should cover the investment which the central-station company has in electric furnace service.

FIFTEEN WAYS IN WHICH TO GET BETTER REGULATION

Three-Wire Network, Readjustment of Transformers, Retirement of Old-Type Units, Avoidance of Low-Power Factor, Etc., Recommended

MANY effective ways exist for securing better voltage regulation which can be applied after a voltage survey has determined the particular remedy necessary. A few of them are worthy of mention and are given in the following paragraphs:

It is absolutely necessary that all voltmeters be carefully calibrated, particularly the station meters. If the latter read too high, it may cost the company a considerable sum of money in lost revenue. Among the causes of inaccurate station voltmeter readings is the connection of pilot lamps across the potential transformers or the overloading of these by other switchboard instruments. They should be disconnected and the station voltmeters checked systematically and regularly.

Three-wire, 110-220-volt, single-phase networks with banked transformers are particularly desirable to improve voltage regulation, and if possible the secondary loops should be closed around city blocks. This evens up the voltage over an area by taking full advantage of load diversity with regard to transformers and copper.

Attention should also be given to the general readjustment of transformers as to size and location for carrying the load. The continual adding of lighting business to particular transformers unintentionally overloads them, and the only safeguard lies in checking all transformer loads with a split-coil cable testing ammeter, which every company should own. Transformers should also be readjusted with reference to their characteristics so that load may divide properly between them. Benefit also results from the retirement of transformers which prove unfit for lighting service.

Voltage regulation may also be improved by separating power business from lighting business. The first separation should be in the secondaries, and the second, if needed, in the primaries. Voltage drop is very greatly increased by the effect of low power factor on the regulation of transformers. A drop of from 4 to 5 per cent at full load is caused by an 80 per cent power factor.

The establishment of centers of distribution, as opposed to the common method of connecting business all along the feeders from the plant outward, is generally attended by benefit. In this connection the ends of adjacent feeders should be connected by fuses in order to take advantage of the load diversity offered. Where automatic voltage regulators are not employed it will usually be found convenient and effective to maintain the voltage at any distant point by adjusting the busbar voltage. This can be intelligently done by once calculating or determining the voltage required at the busbars with different loads to maintain a specific voltage at a distant point and then plotting a curve which would give this information readily. By running back light-pressure wires from the center of distribution to the Tirrill regulator at the plant, constant voltage may also be maintained at other than the plant busbar.

Automatic feeder regulators should be considered at the plant or substation if demanded; if required in outlying districts, they may be of the pole-top type. It should be remembered that regulators, generally, do not cut down the distribution losses. Attention should be given to providing additional copper where the drop is considerable, but the amount added should be determined by balancing losses against the price of copper.

As indicating the magnitude of voltage drop from a center of distribution to individual loads, it might be pointed out that the average is usually more than half the drop from a center of distribution to the farthest load, and investigation shows that the former will be approximately 70 per cent of the latter. Taking 70 per cent of the average maximum drop from each feeder and adding this to the desired lamp voltage, the voltage is obtained at which the feeder regulator should be set.

In individual cases of poor voltage regulation due consideration should be given to the customer's wiring, and if it is too light it should be impressed upon him that changes are necessary.

These suggestions have been received from R. L. Baker, electrical engineer of H. L. Doherty & Company.

Book Review

HANDBOOK OF MECHANICAL AND ELECTRICAL COST DATA. By H. P. Gillette and R. T. Dana. New York: McGraw-Hill Book Company. 1740 pages, illustrated. Price, $6.

The old objection to handbooks on cost data is still raised, but it is hardly justified provided that the original contributor of the information, the conditions (including the date) to which the data apply and the itemized labor charges or time spent on different work are given. Since the electrical engineering field has been without any cost-data book until recently, the information which has been compiled by Messrs. Gillette and Dana should be more than welcome. Their professional positions and past contributions in the form of reference data speak for the accuracy and reliability of the data just published. The information has been compiled principally from technical journals, engineering society publications, etc., but the authors have also included some of their personally collected data. If there were more of the latter, it would enhance the value of the handbook considerably. The original source of the information, itemized labor expenses and the date to which the figures apply are given in most cases. The value of this information cannot be too strongly emphasized, for without it assurance cannot be placed on the reliability of the data, nor can they be applied intelligently at a later date when conditions are different. Additional information might be given to advantage in the form of a short summary of conditions which vitally affect construction and labor costs—for example, geographical location, topographical or geological conditions, etc. Since labor expenses differ so in different places, it would seem preferable, where possible, to analyze the man-hours required for different work instead of giving labor expenses, in order that different labor unit costs could be more easily applied. In a handbook that is intended to give only cost data information which is not closely related is out of place. Occasional examples of this kind occur that might better give place to data that are lacking, but this is not a prevailing characteristic. Since designers and constructors represent only a portion of the electrical industry, unit maintenance, operating and repair costs could be included to advantage. Some improvement can also be made in the arrangement of the information and index so that ready reference will be facilitated; but as a whole the Gillette-Dana handbook is very satisfactory.

INDUSTRIAL APPLICATIONS

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

GROUPING THE CABLES BEHIND SWITCHBOARDS

Cables Threaded Through Steel Plates Set at Right Angles to Switchboard and Attached to Panel Supports

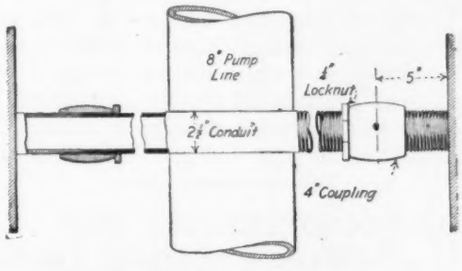
To permit grouping cables neatly above one switchboard which the L. K. Comstock Company installed, it attached $\frac{3}{16}$-in. (4.8-mm.) steel plates to each panel support at right angles to the switchboard and framed these plates with channel irons. Holes were drilled in the plates and nippled so that the cables could be threaded through to their respective switch studs. The top and sides of the framework were inclosed in No. 12 gage steel plates and the bottom closed with $\frac{1}{8}$-in. (3.2-mm.) transite boards in which holes were later drilled for feeder drops to the switch studs. This latter operation was not performed, however, until all the rest of the work was done.

To facilitate handling the switchboard panels, which measured 7 ft. by 24 in. by 2 in. (2.1 m. by 60 cm. by 5 cm.) with switch studs extending about 3 ft. (90 cm.) to the rear, cribs mounted on rollers were employed.

EMERGENCY ARRANGEMENT FOR UNCOUPLING CONDUIT

As Both Ends of a Conduit Crossing a Pipe Line Were Rigid, Quick Removal, in Case Either Line Had to Be Overhauled, Was Necessary

In one industrial plant where a motor feeder crosses a pipe line at right angles some method had to be employed to allow easy and quick removal of the conduit in case of an emergency, since it was rigidly held at



SECTION OF CONDUIT CROSSING PIPE LINE CAN BE REMOVED BY LOOSENING LOCK NUT AND UNSCREWING COUPLING

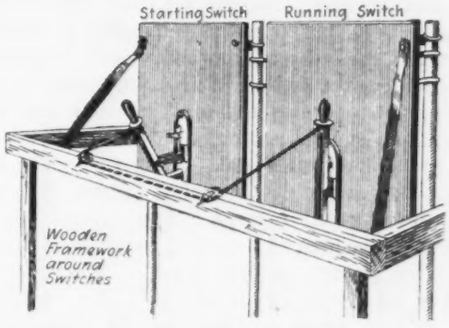
both ends. To do this the conduit was sawed off so that about 5 in. (12.7 cm.) extended into each side of the trough in which the pipe was laid. The ends were threaded so that a 4-in. (10-cm.) coupling would fit tight when screwed on for one-half of its length. The section of conduit sawed out was also threaded on both ends so that a 0.25-in. (6-mm.) lock nut and the coupling would screw on easily. By holding the short section of conduit in position, turning back the couplings and jamming the lock nuts against the couplings the conduit line is made completely rigid.

Plainfield, N. J. IRVING E. SWEAZEY.

SIMPLE SWITCH INTERLOCK FOR TEMPORARY INSTALLATION

Rope and Pulley Arrangement Prevents Starting and Running Switches on 13,000-Volt Motor from Being Closed at Same Time

With the installation of the temporary equipment for a substation in an industrial plant there was some apprehension on the part of the employees that the starting and running switches for a 300-kw., 13,200/220-volt



ROPE BETWEEN SWITCH HANDLES PREVENTS BOTH BEING CLOSED AT SAME TIME

motor-generator set would be closed at the same time with consequent damage to the compensator. It was not considered worth while to purchase mechanically interlocked switches for the service, so a simple arrangement of ropes and pulleys like that shown in the sketch was used. Closing the starting switch automatically opens the running switch and vice versa.

AUTOMATIC "FOOLPROOF" CONTROL FOR LATHES

Permits Unskilled Operators to Handle Equipment at Top Speed Without Danger of Accident or Spoilage

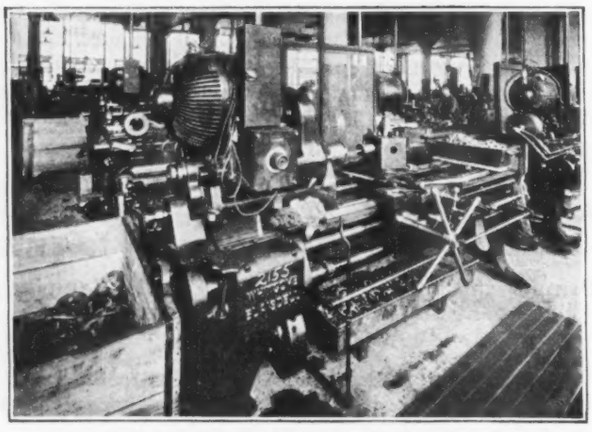
At the Blake & Knowles Company's factory, Cambridge, Mass., special attention has been given to automatic control of lathes, in order that operators without the slightest electrical knowledge may handle the equipment at top speed and without danger of accident or spoilage. The representative installation illustrated shows a 24-in. (60-cm.) Whitcomb-Blaisdell lathe in this plant, driven by a 7½-hp., 220-volt compound motor with shunt-field control, permitting 400 to 1200 r.p.m. The main-line knife switch is mounted against the side of the motor frame in an inclosed cabinet. Directly below this, upon the headstock, is a speed-

setting device which is used in predetermining the speed at which the motor will run in a given case.

The lathe is fitted with a turret head, the apron being thrown to the right to show this device. The lathe is equipped with a splined shaft, to which is connected by a chain drive, shown at the extreme right, the master switch of the controller. This chain drive and master switch are better shown at the extreme left, mounted upon a duplicate lathe, with back-to-back installation for space conservation. A controller panel, carrying magnetic main switches, accelerating and field commutating switches, is shown at the rear, just above the lathe bed and under the turret head, and upon the splined shaft and attached to the apron is an operating shaft equipped with an electrical control handle. The control equipment is of the Cutler-Hammer type.

As soon as the speed for a given operation has been predetermined, the operator has full control of the equipment from the handle on the apron of the lathe, which permits forward rotation, stopping and reversing at a predetermined speed. In one section of the turret head is mounted a drill, and in the other section is a tap. The lathe shown is used in boring and tapping holes in hand wheels for small valves.

In working, the operator places the blank in the chuck and advances the turret, holding the drill to the piece, then throwing the operating handle upon the apron of the lathe to forward speed. This operation throws the master switch in that direction of rotation, which in turn operates the pilot circuits for the main-control panel, and the motor is automatically accelerated to the predetermined speed. As soon as the drill has performed its work the operator throws the operating handle to full-speed reverse. The control panel automatically decelerates the motor, reverses it and brings it up to the predetermined speed in the reverse direction, thus withdrawing the drill. The operator then throws in the turret so that the tap comes into play and repeats the operation. Should the operator force the feed too fast and tend to overload the motor, an overload movement trips. Under such conditions it is



AUTOMATIC LATHE WITH ADJUSTABLE-SPEED COMPOUND MOTOR

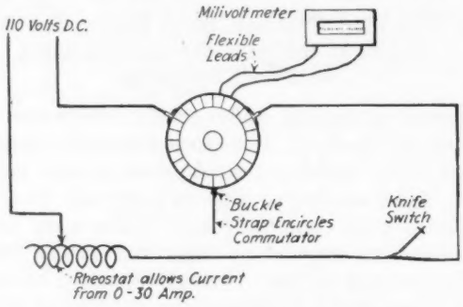
not necessary for the operator to leave her position at the apron of the lathe, the resetting of the trip being done by throwing the master switch to the off position. Dynamic braking is employed in stopping the motor from both forward and reverse positions. This type of equipment has been used to great advantage in piece-work operations.

Boston, Mass. H. S. KNOWLTON.

ARMATURE COIL TESTER FOR PLANT REPAIR SHOP

Shop-Made Arrangement Allows Repair Man to Tell Exactly Where Fault Is Located — Millivoltmeter Indicates Cause of Trouble

When armatures are brought to the electrical shop for repair, determination of the location and extent of the fault must be made in order to remedy it in the quickest and most efficient manner. To do this effectively the E. W. Bliss Company arranged a scheme



THE CONTACTS CONVEYING CURRENT TO ARMATURE CAN BE SLIPPED ALONG BELT PASSING THROUGH THEM

which consists merely of a leather strap holding two sliding contacts the distance between which can be adjusted, a millivoltmeter taken from a Brown pyrometer, an old resistance coil and a rheostat switch. The strap is adjusted on the commutator as shown, and the energizing leads are twisted firmly in place. A current is sent through the armature—the amount depending on the size of armature and being regulated by a rheostat switch. The repair man then places the two wires leading to the millivoltmeter on adjacent commutator bars and notes the reading of the instrument. After marking the starting place, he follows this procedure until he has tested all of the commutator bars. The energizing contacts are preferably shifted so that the meter leads are always within the shortest distance between them, otherwise the meter contacts must be reversed as there is a reversal in current.

If the meter reading is the same for all coils, the repair man will know that everything is all right. However, if no reading is obtained there is a short circuit in one of the coils to which the bars are attached. Or, if there is a low reading, there is either a poor commutator surface or poor insulation on the conductors. High readings indicate an open circuit which may be caused by a wire burn-out or a loose connection.

Brooklyn, N. Y. W. V. BOND.

MOTOR TOO OFTEN BLAMED FOR MACHINE TROUBLES

Possibilities of Mechanical Troubles Should Be Investigated So Breakdown Will Be Less Likely After Replacement of Damaged Equipment

The unfailing regularity with which troubles of motor-driven machines are attributed to the motor or to its starter, without even an inspection of the connected machine, has cost operators many a dollar from the supposed need to send a long distance for an electrician when a competent mechanic available on the job could have located the trouble and removed it. The prevailing feeling appears to be that if a motor heats

or sparks the trouble is electrical and must be in the motor. The following cases are in point:

An operator telephoned for an inspector to come 75 miles (120 km.) to find out the trouble with a 20-hp., three-phase induction motor used for driving a conveyor in a paper mill. Investigation disclosed that it was due to the bearings. The motor was operated where it was exposed to extreme cold. This would have been a good thing from a purely electrical point of view, because low temperature helps electrical efficiency; but in this case the lubricating oil, thickened by the cold, could not be handled by the oil rings. Smoothing of the bearings and substitution of winter oil restored normal operating conditions.

In another instance the inspector reached the scene of trouble too late to save one rotor from destruction. The disabled rotor had been packed and was on its way to the factory. A spare rotor had been installed and was ready to be started. It was thought advisable to remove the rotor in order to look things over. Inspection of the starter showed that the first rotor had been rubbing because of worn bearings.

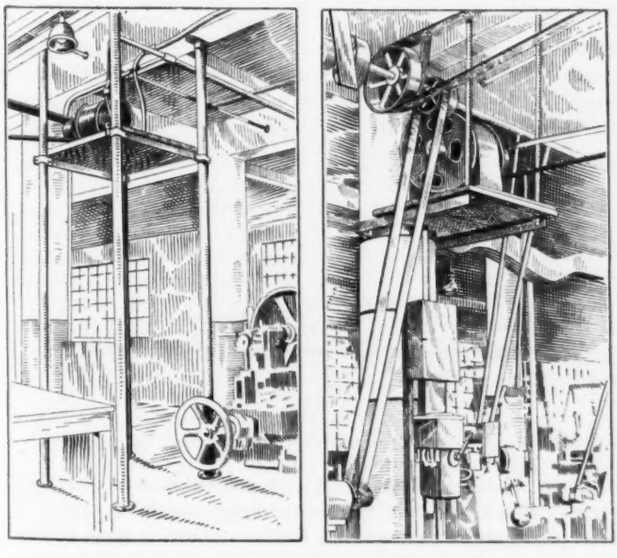
In a third instance a direct-current motor could not be started because the starting box "got too hot." The box did get too hot, but it was on account of a grounded motor field connection, across which and the motor frame lay a wrench used in replacing a grounded coil.

Brooklyn, N. Y. E. C. PARHAM.

SUPPORTING MOTOR ON COLUMN RELEASES SPACE ON THE FLOOR

About 16 Sq. Ft. Is Now Available Under Each Motor Mounting — Also Facilitates Transporting Material to and from Machines by Trucks

Economy of floor space and convenience of control are now being obtained in one industrial plant by attaching the motor stand and control apparatus directly



OLD AND NEW METHOD OF MOUNTING MOTORS

to columns instead of mounting the motors on four iron pipes extending from the floor to the ceiling as was formerly done. As the old supports were about 4 ft. (1.2 m.) apart, some 16 sq.ft. (1.5 sq. m.) of factory space was wasted, and besides the supports usually interfered with the transportation of material.

The improved support is constructed by joining two half-circle iron bands around the column by means of bolts so that they cannot slip and attaching horizontal angle-iron pieces to the joints. The other ends of the angle-iron pieces are held in place by means of vertical ¾-in. (2-cm.) rods attached to the ceiling. The motor is set on a wood platform built on the framework.

The switch box containing fuses and the motor starter can now be mounted on the column directly beneath the motor so that considerable overhead conduit which was formerly used between the starter and motor is avoided. The motor can be easily cleaned, and its location affords convenient inspection.

New York. JOHN SMITH.

FILLERS SUITED TO USE FOR PLUGGING COMMUTATORS

Mixtures of Plaster of Paris, Powdered Mica, Glue or Shellac Can Be Used Instead of Turning Down Commutator

Short circuits which burn themselves clear at the surface of a commutator often burn a hole in the mica and the bars. When the mica is not burned too deep it is often possible to clean out the holes with a thin knife blade and plug them with a suitable filler. When a good job is done and the commutator kept free from oil the plugged section will wear for a year or longer. It is always advisable to save the wearing surface of the commutator in this way whenever possible, for every time a commutator is turned down in a lathe about three years of its useful life is lost.

Fillers which have been successfully used for plugging commuators can be made us as follows: Two parts of plaster of paris, one part of powdered mica and enough glue or shellac to make a thick paste. When this filler is applied it will dry quickly and assume about the same degree of hardness as the mica segments. Another filler can be made up of powdered chalk or plaster of paris and shellac, and still another of water glass and powdered glass. The choice between these fillers largely depends upon the availability of the materials since one works about as well as another. These fillers should only be used for small holes. When the segment is burned deep down the only successful remedy is to remove the bad segment and insert a new one.

St. Louis, Mo. HENRY HAZLETON.

Power Requirements of Stone-Crushing Plant

Records of the energy consumption of a stone-crushing plant in Massachusetts equipped with a 20-hp., 550-volt, three-phase induction motor and operated eight months of the year are given below. The crusher is fed by gravity.

Month	Cost of Service	Kw.-Hr.	Tons Crushed	Demand (Kw.)
May	$50.76	950	1042	17.3
June	35.14	610	701	17.9
July	33.98	590	596	22.4
August	50.22	930	1082	25.4
September	62.10	1150	1240	37.2
October	61.02	1130	1308	22.4
November	69.66	1290	1343	30.9
December	65.88	1220	365	27.6
Total	$428.76	7870	7677	....
Cost per ton for energy				$0.0536
Kw.-hr. per ton				.983
Average kw.-hr. per month				983

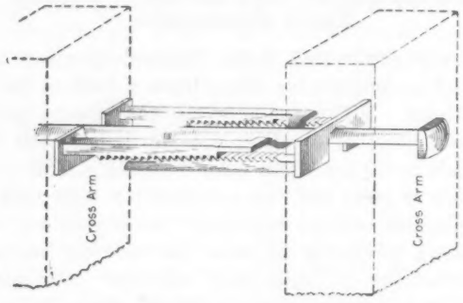
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METAL CROSS-ARM SPACER FOR POLE-LINE CONSTRUCTION

Adjustable Steel Cross-Arm Spacer Saves Time and Labor in Installation Work—Description of the Apparatus

A so-called "saw-tooth" spacer has been designed by S. B. Hood, superintendent of distribution for the Minneapolis (Minn.) General Electric Company. The use of this device saves labor in sawing up old cross-



ADJUSTABLE SPACER FOR DOUBLE ARM CONSTRUCTION

arms for space blocks; it saves time in installation since there is only one nut to tighten instead of four, and it also saves cross-arms which would otherwise be sawed up to use as space blocks. It is inserted near the end of double arms to displace bolt-and-block types of spacers and consists of two pieces of malleable iron about 3.5 in. (12 cm.) in length and exactly alike. The saw-like teeth of one piece engage with the teeth of the other piece to make the spacer adjustable to any length.

The through bolt used passes through metal straps on both pieces of the spacer. This holds the teeth engaged so that they cannot slip and also prevents the pieces from falling if the spacer should become loose for any reason. When the nut is tightened both the arms and the spacer are held in place by the one through bolt.

TITRATION TESTS REDUCE BOILER BLOW-DOWN LOSSES

Several Companies Are Adopting Methods for Testing Water in Boilers to See When Boiler Needs Blowing Down

In connection with blowing down boilers the old practice has been to blow down at stated intervals, possibly two or three times in each twenty-four hours. This method has been found in some instances to be wasteful of steam, since it costs from $25 to $50 to blow down an ordinary central-station boiler. Titration tests have been worked out which permit the boiler-room force to test the water in the boiler at stated intervals in order to find out when blowing down is necessary.

These titration tests are merely simplified methods of making a chemical analysis of the water to determine what percentage of solids it contains.

The following way of going about such tests is used by the Union Gas & Electric Company of Cincinnati, Ohio.

Chlorinity.—Solutions: Silver nitrate, 1 cc. $AgNO_3$ neutralizes 1 mg. Cl. Potassium bichromate, indicator. Procedure: Add four drops of indicator to 100 cc. of the sample and titrate with silver nitrate. A reddish-brown color indicates the end point.

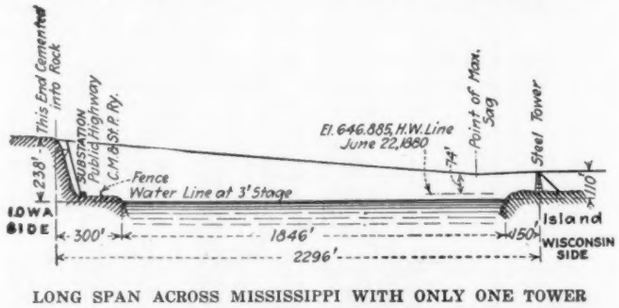
Alkalinity.—Solutions: Hydrochloric acid, 1 cc. HCl neutralizes 14.3 mg. $CaCO_3$. Phenolphthalein, indicator. Methyl orange, indicator. Procedure: Add four drops phenolphthalein to 100 cc. of the sample and titrate with hydrochloric acid until coloration disappears. Then add methyl orange and continue titration until the faintest pink coloration appears. The total titration represents the alkalinity.

Computation: Percentage is calculated as the ratio of the number of cubic centimeters used to the amount of the sample taken. Limits: 10 per cent of chlorine, 20 per cent of alkalinity.

RIVER SPAN CARRIED ON ONE TOWER

Taking Advantage of High Bluff on One Side of River Reduces Cost of Span by $2,500

In stringing a transmission line across the Mississippi River between the cities of Prairie du Chien, Wis., and McGregor, Iowa, the Interstate Power Company found it possible to dispense with one of the towers by anchoring the line into the rock bluff 225 ft. (68 m.) high on the Iowa side of the river. The span consists of three lines of ½-in. (1.25-cm.) seven-strand, extra-



LONG SPAN ACROSS MISSISSIPPI WITH ONLY ONE TOWER

high H. S. steel wires, on which the maximum working stress is 12,000 lb. (5443 kg. per sq.cm.). On the Wisconsin shore there is an 80-ft. (24-cm.) steel tower. A concrete "deadman" was laid in the rock which forms the bluff on the Iowa shore. When the span was completed copper wires were dropped down to the McGregor substation, which is situated near the foot of the bluff.

By taking advantage of the high bluff only a small height of tower was required, whereas had there been

no bluff high towers would have been required at both ends of the span. The utilization of this bluff also resulted in using the equivalent of a very large sag, accounting for the use of wire of only ½ in. (1.25 cm.) diameter for this long span. It is noteworthy that the lowest point of the span is only a few feet below the top of the tower. It can be readily seen when it is known that the tower as constructed on the Wisconsin side cost $2,500 that a greater amount than this sum was saved by adapting the construction to the natural advantages offered.

WHERE TO DIRECT ATTENTION TO INCREASE ECONOMY

Some Frequent Sources of Losses Pointed Out by Pennsylvania Water Power Company — How to Eliminate Waste

For about four years the Pennsylvania Water Power Company has been trying to utilize water power in its hydroelectric plant at Holtwood, Pa., more economically and in so doing has suggested the following methods to its operators. The results have been very satisfactory and were especially so during the war, when every bit of water power utilized meant just so much more coal saved:

Tailrace Improvements:

(a) Clean out the channel, removing reefs, obstructions or constrictions.

(b) Deepen or widen the channel.

(c) Make the channel more uniform in sectional area.

(d) Make the sides and bottom smoother.

(e) Extend the channel so as to discharge further down the river at a lower elevation.

(f) Improve the seal by lengthening it or making it adjustable, or in some way make it discharge more freely, so as to diminish the backing up of water over the seal when the flow of water in the tailrace is great.

Raising Head Water:

(a) Raise the crest of the dam by installing crest gates.

(b) Use flashboards on the dam crest.

(c) Improve the flow conditions between river and turbine intakes.

Increasing Output Capacity of Generators:

(a) Install new generators of greater output capacity and throw the bulk of low-pressure factor generation on such new units.

(b) Install new windings in existing generators.

(c) Place fan blades on generator rotors.

(d) Provide forced ventilation, thereby (1) obtaining a supply of cooler air; (2) using air washers; (3) using deflectors on the generators to get a better distribution of cooling air through the hotter parts of the generator, or by using deflectors in air passageways to secure a better supply of air to individual generators; (4) providing better air drafts in the station, better air exits, removing hot-air pockets and maintaining a cooler station.

(e) Install temperature coils in the generator windings and operate the generators up to the safe temperature limits possible, being guided by the temperature indicators.

(f) Decrease the iron loss and increase copper loss by operating at a lower voltage in case iron loss is the limiting factor in generator output, or vice versa if copper loss is limiting factor.

Reducing Leakage or Diversion of Water:

(a) Pay more particular attention to leakage through flashboards, or leakage through waste gates, stop logs, etc.

(b) Reduce to a minimum the amount of water diverted through fishways.

(c) Guard against wasting water in auxiliaries or through valves carelessly left open.

(d) Be more careful to manipulate the level of water above the dam to avoid overflow over the dam crest, or splashing of water over the dam because of wind.

Efficient Use of Auxiliaries:

(a) Run the auxiliaries at their most efficient outputs and operate the minimum number required for proper service.

(b) Run the most efficient auxiliary units whenever possible.

(c) Run turbine-driven auxiliary units when there is ample flow, and motor-driven units during low flow.

Increasing Output Capacity of Turbines:

(a) Install new and more efficient runners in existing units.

(b) Keep the trash racks and water passages freer from rubbish by a frequent removal of the latter.

(c) Make the water passages smoother, if they are very rough.

(d) Decrease the turbulence at the draft tube outlets.

(e) Take up the back lash in turbine-gate rigging more frequently, which back lash tends to prevent the turbine gates from opening to their full extent.

(f) Install new and more efficient units with improved gate rigging on foundations which are available and not now in use.

Economy During Low-Flow Periods:

Make studies to determine the best loading points of generators by observing operating results, by making efficiency and power tests of equipment and by obtaining data from the manufacturers.

Load Dispatching:

(a) Strive to improve in predictions of river flow and customers' loads.

(b) Use the power and energy available from the steam plants and water-power plants in such fashion as to obtain the minimum coal consumption consistent with maximum utilization of hydraulic energy and with the peak loads and energy demands at the time; *i. e.*, obtain more fully the benefits to be gained from interconnection of steam and hydraulic electric generating stations.

(c) Make more careful observations of the fluctuations in flow produced by dumping of water from up-river plants under different conditions.

(d) Arrange with up-river water-power plants for modification of their operating methods and for notifications in event of irregular operation.

Baltimore, Md. ALEX BAUHAN.

PORTABLE RIG FOR SETTING HIGH-TRANSMISSION LINE POLES

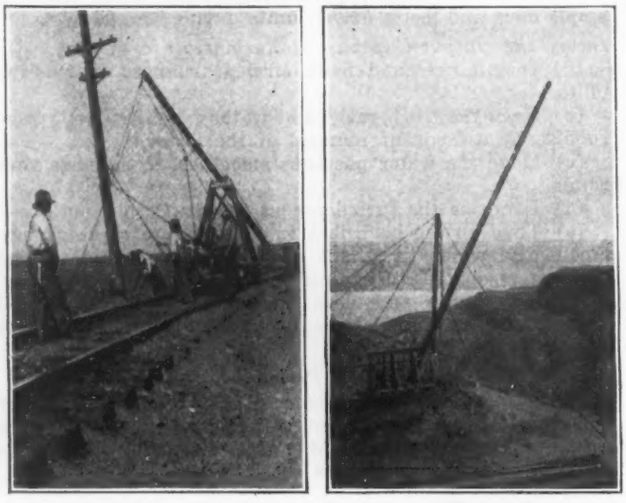
Gin Pole Is Mounted on Sled and Hauled by Team—This Results in Rapid Erection of Poles Along C., M. & St. P. Electrification

A gin pole hinged to a sled mounting has been successfully used by the Chicago, Milwaukee & St. Paul Railroad for erecting wooden poles up to 85 ft. (26 m.) long on the 100,000-volt transmission line between Spokane and Seattle. The saving in labor effected by the use of this device was considered even more important than the saving in cost. Handling these long poles by hand was very hard on the men, while with the portable rig the work is easy and a smaller crew is required.

The crew operating the portable rig normally consists of five linemen, seven helpers and one teamster. The rate of setting varies widely with the country traversed, of course, the range being from twenty poles per eight hours in very rough country up to thirty-seven in easy country, the average being about twenty-five poles per day. The gin pole with its sled support and guys weighs only 870 lb. (395 kg.) so it is easily moved along the line by the team.

Guy lines, attached to the top of the gin pole, are run out to deadmen as required at each setting. By laying the pole to be erected with the pick-up point immediately

over the hole it was possible to place it with a direct vertical lift, thus avoiding the danger of knocking earth into the hole and decreasing its effective depth. Work on this same line previous to the adoption of the port-



ERECTING POLES FROM TRACK AND AT A DISTANCE FROM THE RAILROAD

able rig showed that poles exceeding 65 ft. (20 m.) in length could not be erected by hand without a special rig.

Seattle, Wash. F. B. WALKER.

CHARACTERISTIC FEATURES OF TRANSFORMER INSTALLATIONS

Automatic Oil Switches with Self-Contained Series Trip Coils for 2300-Volt and 4600-Volt and Insulated High-Tension Wiring for 11,000-Volt Service

In outlining the practice of the Cleveland (Ohio) Electric Illuminating Company in constructing its transformer installations, G. B. Schneeberger, electrical engineer for the company, recently brought out the following points before the transmission and distribution committee of the Ohio Electric Light Association.

The transformer vaults for 2300-volt and 4600-volt work are built of brick or concrete block and are provided with a corrugated iron roof. A separate compartment is provided for the watt-hour meter. An automatic oil switch with self-contained series trip coils is provided on the primary side of the transformers. This switch is mounted so that it may be operated from the outside of the transformer compartment and takes the place of the usual low-tension knife switch, commonly used as a service switch. It also eliminates heavy low-tension fuses. It is troublesome to maintain a heavy-current knife switch under the operating conditions experienced in the average factory. Lightning arresters are installed on all primary cable services at the point where they tie to the overhead lines. Occasional trouble due to lightning has been experienced with oil switches having self-contained series trip coils. These coils should preferably be below the normal oil level in the switch tank. The majority of the transformer installations consist of three-phase units.

The heavy power consumers, such as electric furnace installations, rolling mills and large manufacturing plants, are supplied direct from the 11,000-volt transmission system, which is entirely underground. The transformer vaults for 11,000-volt installations were formerly built of corrugated iron, but during the past few years brick has been used. In addition to the transformers the transformer vault also houses a high-tension switchboard. This switchboard consists of masonry cells built of brick with sandstone barriers and contains the knife disconnects, automatic oil switches and primary metering equipment. In most cases duplicate service cables are installed which terminate in interlocked hand-operated automatic oil switches. As a safety measure the switch-operating handles are so mounted that in case one cable fails the local electrician can switch to the opposite cable without entering the high-tension transformer vault. All high-tension wiring is insulated with varnished cambric and covered with a flame-proof braid. The use of insulated high-tension wiring and the cell construction make a compact switchboard.

BUILDING SUBSTATIONS IN RESIDENTIAL DISTRICTS

Substation Erected During the War Is Harmonized with High-Class Residential Community in Which It Is Situated

The Piedmont Avenue railway rotary substation of the Georgia Railway & Power Company was built during the war to take care of the enormous passenger traffic between Camp Gordon and Atlanta. It is situated about 7 miles (11 km.) from the the center of the city, taking 22,000-volt, 25-cycle energy from the Morgan Falls plant, 20 miles (32 km.) away.

This substation was built in a restricted building section that is being developed with very fine residences and small villas, and for that reason it was decided to build something in keeping with the future surroundings. The photograph gives a very fair ex-

ORNAMENTAL CONVERTER SUBSTATION AT ATLANTA

ample of what can be done during emergency times and under extreme conditions, showing that a rotary substation can easily be made ornamental as well as useful. This station contains two 500-kw., six-phase rotary converters and is finished inside with black floor and wainscoting, white walls and natural-finished flat ceiling. It has an abundance of light and ventilation and is electrically heated in winter time.

Atlanta, Ga. G. A. ILER.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SELL HOME SECURITIES NOW, ADVISES JOHN F. GILCHRIST

Tells Missouri Utilities Association of Opportunity Which Private Owners Have to Show Fallacy of Municipal Ownership

Public utility commissions in practically every state have been subjected to attacks during or since the war period, and in all cases the attacks have failed or have fallen far short of their purposes. This evidence of stabilization is important, said John F. Gilchrist of Chicago, speaking before the Missouri Public Utilities Association at Excelsior Springs, Mo., June 7. Its effect on public utility securities will certainly be felt. Evidence of this is available in the experience of independent telephone men in Illinois. These men have for a long time followed a policy of raising their required capital locally. Before the formation of the commission the market for these securities was uncertain to such an extent that local bankers could not be interested in them. Now, however, this has changed so that bankers do buy the telephone securities, thus making a market for the issues.

The application of this experience is particularly interesting to central stations now, for more and more it will be desirable to go to local people for financing, not only because it is a means for raising money, but also because it provides a method of drawing toward the utilities the real interest of the people which they serve. Such action will unite the customers' interest with that of the company and will lay a sound foundation for future financing. Care must be exercised, of course, that such securities as are sold to customers of the company will stand up. However, there is little to fear from this score in any modern conservatively managed company.

The time to start selling these securities is now, said Mr. Gilchrist. Moreover, it is probably a good idea to start in a small way. Investment habits are being formed by many people now, and the investment habits formed early in life are likely to be sustained. For instance, the type of securities in which a man invests between the ages of twenty-one and thirty years are likely to remain his favorite investments throughout life. "In addition to this," the speaker added, "I believe that utility securities have seen the worst and that they will in the future have the solid respect which they earned in the past."

Touching on municipal ownership, Mr. Gilchrist referred to it as a storm center which will have to wear itself out. In this storm center the Kansas City *Star* is an important center of influence. But, instead of worrying about this, the private owners should grasp the opportunity which now confronts them to get busy and show the public what a strong recovery from war conditions has been made and how good privately operated public service can be. In this connection there is an opportunity to accentuate the point that service from governmentally operated utilities is not and has not been up to a standard which its patrons desire and demand.

SAYS UTILITIES MUST DETERMINE OWN FUTURE

President Edgerton of California Commission Thinks Private Ownership Will Be Settled by the Way Companies Meet New Conditions

Survival of the system of private ownership of utilities depends upon the companies themselves and the manner in which they meet the problems of reconstruction, declared E. O. Edgerton, president of the Railroad Commission of California, in an address delivered at the recent convention of the Pacific Coast Section, National Electric Light Association.

The question of municipal ownership, said Mr. Edgerton, will not be decided by any discussion of an academic nature as to whether public ownership is good or bad, but upon the conclusion of the people as to whether or not the private agency now operating is successfully meeting their needs. If the judgment is adverse, there is only one alternative, and that is public ownership. A utility is a monopoly, and there is no place for the people to turn to if they become dissatisfied with its service. Give them bad service, said the speaker, and they will rebel, and if they face a monopoly that will not give adequate service they will do the job themselves.

Commissioner Edgerton said that in his judgment the issue was not, "Shall we have public ownership at this moment?" but "Will the private agency successfully meet the needs of the public?" He thought the answer to this question rested with the public utility men themselves. Their contact with the public would determine it, and if they should fail it would be their own doing.

Upon the ability of utility men to convince the public they are giving real service depends the question of whether or not private ownership is to persist, said Mr. Edgerton. It is not the judgment of the companies themselves as to the kind of service they are rendering, but the judgment of the people, that counts; and no matter how the utility men themselves feel about the quality of their service, if the public does not think it the best that can be supplied, their day is done.

"Are you willing to make sacrifices, to bend every effort to make good?" asked the speaker. "If you are not willing, your case is lost. The public is tired of promises. It is tired of mere pronouncements. It has listened to arguments on public and private ownership until it is utterly confused as to the merits of the two. If the prime purpose of the utilities of California is to give service, that means that every man in the convention must stand up and fight in every sphere he occupies in the public utility camp for the proposition that

service comes first. If you are not prepared to make that fight, take the easy way. Your day is over."

He said that throughout the great body of the people there had occurred a shifting of doubt, a change in thought, new ideas, and that there was just one way to meet that condition and that was to change ideas and doubts to conform to that condition. If utility men were sincere when they asserted that service is first, they could convince the people. If they were not sincere, the job of convincing the people was utterly hopeless. All the advertising, explanations and excuses in the world would count for nothing if they were not prepared with conviction to go to the people with the proposition that their welfare comes first. If anywhere along the line there was not confidence in this proposition, the whole scheme of private ownership must fail.

There is a new battle ahead, warned President Edgerton, and the utilities are going into that battle, if they are to win, upholding the idea of giving the people service through private ownership to the extent that they practically make that an ideal. They are going to fight, if they hope to win, with new weapons, with the "bunk" cut out, with all the old schemes of fake excuses gone. These new weapons are: Service first, patience, honest explanation. The utilities must hold the determination, first, that their cause is righteous; second, that the people shall understand this cause.

Commissioner Edgerton pointed out that private ownership was going against increased operating expenses, and that unless remedial legislation were adopted which would give it a fair chance, it was hopeless of success. In the telephone situation the public was enraged, and he gave warning that unless care is exercised when the telephones shall go back to private ownership the public may wreak vengeance upon that private ownership.

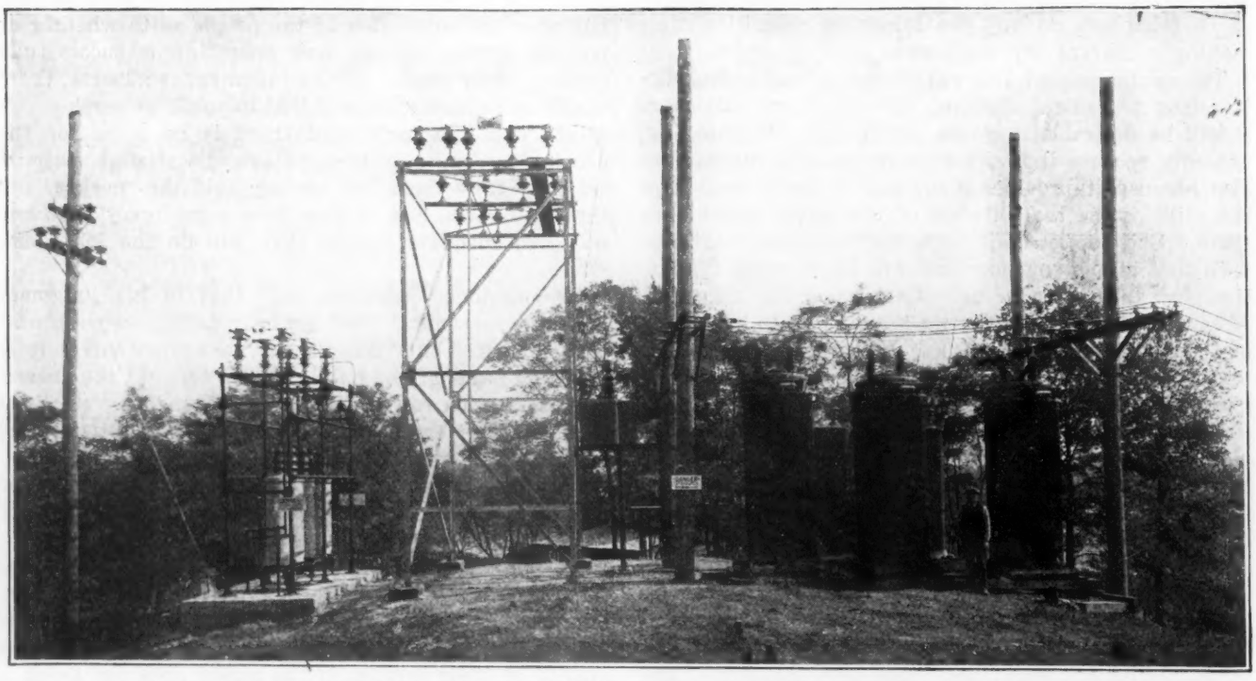
Throughout the ranks of public utilities must go the ideal of serving the people, declared Mr. Edgerton. This ideal must be above profit and loss, for no organization of human beings will work and fight at its best merely for profit. The kind of service that must be given if private ownership is to continue is impossible unless such an ideal prevails.

METERING PRACTICE FOR 33,000-VOLT OUTDOOR STATION

Dayton Company Central Station Incloses Whole Equipment in Iron Case and Does Not Fuse Potential Transformer

Several outdoor substations that are more or less isolated have been erected by the Dayton (Ohio) Power & Light Company to supply energy for the flood-prevention work of the Miami conservancy district. Because these stations are installed in out-of-the-way places, and because they handle relatively large amounts of power, it was necessary to devise accurate and reliable means of measuring the energy.

The equipment consists of a polyphase 33,000/110-volt potential transformer with two double-ratio current transformers, all mounted, oil-immersed, in the same case. The potential transformer is not fused but is protected from lightning by a small choke coil. The current transformers have one side grounded to the outlet cap on the terminal with the right side insulated therefrom. These transformers are arranged with a convenient adjustable disk which acts as a spark gap for any surges that may come over the line. The front of the metering case is arranged as a compartment for the watt-hour meter and testing panel. The meter used in conjunction with this outfit is the Westinghouse type RA combined watt-hour meter and maximum-demand meter equipped with a forty-day clock and self-inking pens. These installations have proved to be quite successful. This information was supplied by Charles P. Garman, superintendent of meter department, Dayton Power & Light Company.



OUTDOOR SUBSTATION OF DAYTON ELECTRIC COMPANY SUPPLYING ENERGY IN WORK OF FLOOD PREVENTION

DIGEST OF ELECTRICAL LITERATURE

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Limitation of Earth Currents and Arcing by Earthing Reactance.—W. PETERSEN.—Experiments are described showing results obtained at the Alt-Württemberg supply station. Since the use of earthing reactance the magnitude of the earth currents and the arcing at switch contacts have been greatly reduced. Also, the number of operations of the automatic circuit breakers have decreased from about thirty a month to about one a month.—*Technical Supplement to Review of Foreign Press*, April 29, 1919. (Abstracted from *Elektrot. Zeits.*, Jan. 2 and 9, 1919.)

Plant Extensions at the Kingston-Upon-Thames Electric Power Station.—The Kingston public supply is single-phase, 77 cycles and 105 volts at consumers' terminals, generation being at 2100 volts and consumers being supplied through step-down transformer substations. In recent extensions single-phase generation has been replaced by a three-phase system with its greater flexibility and convenience for future development. This has necessitated a link between the three-phase and single-phase systems. Problems introduced in paralleling these frequency-changing sets are discussed in this paper.—London *Engineering*, April 18, 1919.

A Voltmeter for Synchronizing Purposes.—G. KEINATH.—For synchronizing purposes it is desirable to have definite readings at the bottom of the scale. It is proposed to do away with the usual resistance, which has a negligible temperature coefficient, and to replace it by one that varies considerably with the applied voltage. At low voltage—*i.e.*, with low current—this resistance would have a low value, which would increase with the current. A tungsten lamp provides a suitable resistance of this kind; when hot its resistance is ten or twelve times its cold resistance. The rate at which the resistance varies depends on whether a vacuum of the gas-filled type is used. If a lamp of this kind is put in series with a voltmeter, it is plain that the divisions on the lower part of the scale will be farther apart and therefore more decidedly marked. A voltmeter of the hot-wire type is the most suitable for the purpose. If an instrument with a rotary armature is employed, it will be desirable to give the core a suitable shape if the lamp is to produce the best effect. From curves given it is seen that whereas with a constant resistance the lowest part of the calibration curve is flat, after which point it rises rapidly, with a variable resistance the curve rises rather abruptly at first and more gradually over the rest of the scale.—*Science Abstracts, Section B*, March, 1919. (Abstracted from *Elektrot. Zeits.*, Nov. 14, 1918.)

Notes on Surface Condensing Plants.—R. J. KAULA.—The discussion is particularly devoted to the design of surface condensers and to the general arrangement and layout of condenser plants for large power stations. Equations are developed for the calculation of water required for surface condensers under various conditions. The question of the parallel flow of water and steam versus the counter-current principle in surface condensers is also considered. The author states that of the various air pumps in use the Edwards pump is the only example of reciprocating pumps that can still hold its own in large installations. Regarding rotary air pumps, the characteristics of the earlier designs were such as to show very little difference in capacity between high and low vacua. These disabilities have been overcome in later designs, but the efficiency of such pumps is still low. The steam-ejector type of air pump represents a development of the Parsons vacuum augmenter. In their simplicity they equal the water-jet type, with the advantage of using pipes of small dimensions instead of comparatively heavy water pipes. In power consumption it is claimed that although the quantity of steam consumed is appreciable, practically the whole of the heat value is returned to the feed water. The characteristics of circulating pumps should be adapted to those of the prime mover, and when this latter permits of speed regulation the pump should be able to take full advantage of this feature without loss of efficiency. It is then possible to regulate the water supply according to the head by varying the pump speed, and this method is much to be preferred to throttling. In smaller stations there has been extensive adoption of steam-turbine-driven pumps, but it seems preferable to drive the condensate pump electrically. Apart from the absence of speed regulation, an induction-motor drive from the main supply is not to be recommended, especially on fluctuating loads.—London *Electrician*, April 25, 1919.

Surges in Coils with Alternating Current.—W. ROGOWSKI.—The author examines the problem, taking the case of a coil with two turns only. This case has the advantage that it can be treated mathematically as a coil and need not be replaced by "lumped" capacities and inductances. The treatment is based upon the substitution of a stepped sine wave for the wave of the applied emf. Each step has a time duration corresponding to the time taken by an electromagnetic wave to traverse the coil. The effects can then be studied as the resultant of the summation of the waves corresponding to each step. The author finds that for low and medium frequencies the coil behaves like an inductance shunted by a capacity. As long as the wave length of the impressed voltage is not less than twenty times the length of the wire itself the capacity and inductance may be regarded as independent of frequency. At a frequency corresponding to the resonance frequency of the combination no current flows at the terminals, assuming that the resistance is negligible. There is a current node and a potential loop at the terminals and a current loop at the middle of the coil. This frequency corresponds to Bohm's critical frequency. At a higher frequency n_0, at which the wave length of the impressed

voltage is equal to the length of the wire, the coil acts like an inductance and capacity in series and displays resonance, with a current loop at the terminals and a possibility of an abnormally high voltage in the middle of the winding. As the frequency of the impressed emf. is increased these two forms of resonance alternate with each other, the current at the terminals being zero for each case of the former type and a maximum for each case of the latter type.—*Science Abstracts, Section B*, March, 1919. (Abstracted from *Archiv. f. Elektrot.*, 7, 1918.)

The Hydroelectric Power House of the Ance.—JACQUES DE SOUCY.—A long, well-illustrated article on this hydroelectric installation of the Compagnie Electrique de la Loire et du Centre, which serves the industrial regions of Saint-Etienne and neighboring places. It began operation in 1916 and is able to produce annually about 30,000,000 kw.-hr., indicating a saving of 45,000 tons of coal. The first part of the article gives a history of the project, executed almost entirely during the war, and a detailed description of the hydraulic and power-house construction. The second part deals with the electric installation, which is of the most modern description. From his platform the operator in charge, by simple maneuvers, can transmit to the network of the company a total load of 14,800 kw., or can divide his power house into two distinct parts and cause each of them to work in unison with other steam or hydroelectric plants, or can put groups of machines automatically in or out of service according to the demand.—*Revue Générale de l'Electricité*, May 3 and 10, 1919.

Traction

Brown-Boveri Locomotives for the Swiss Federal Railways.—J. BUCHLI.—The question of the general adoption of electric traction was considered by the Swiss Federal Railways some years before the outbreak of the war. After careful consideration it had been decided to adopt the single-phase system. A new design of locomotives with individually driven axles is being considered for the extensive electrification plans. Brown, Boveri & Company have been intrusted with making tests in connection with the arrangement of drive, since the results obtained from locomotives having the drive by means of coupling rods has in general not proved entirely satisfactory. Twenty-four heavy freight and express locomotives have already been ordered and work on this equipment is now being pushed.—London *Engineering*, May 2, 1919.

British Railway Electrification.—PHILIP DAWSON.—The problem of the general electrification of British railways and its effect upon the more general use of electrical energy is taken up by the author. The discussion may be summarized by the following thirteen points: (1) In the case of suburban services with short distances between stations and heavy traffic electrification increases the average speed of the trains and the carrying capacity of the line, while giving better conditions of traveling. (2) On congested interurban lines electrification gives greater facility in handling the traffic, increases the traveling facilities and results in better traveling conditions. (3) In the case of underground lines or of lines with many tunnels electrification gets over the difficulties of ventilation. (4) In the case of railways operating in the neighborhood of highly inflammable materials electrification gives a degree of safety not possible with steam. (5) In the case of lines in mountainous countries electrification increases the capacity of existing lines and enables new lines to be built with heavier gradients and therefore with smaller capital cost than would be possible if steam haulage were adopted. (6) In the case of freight yards where trains are made up, where a great deal of switching takes place, electricity enables the traffic to be handled more economically and more rapidly. (7) In cases where, owing to increase in traffic, existing railway facilities are not sufficient, the capacity of the line can be largely increased by electrification, which may prove less costly than widenings. (8) Electrification enables the capacity of a terminus to be very greatly increased. (9) The war has demonstrated that the railways are the arteries of the nation, which enable it to live, and countries, therefore, possessing no coal of their own but having water power feel it essential to electrify in order to be independent of foreign countries for their transportation. (10) In non-industrial areas where electrification of the railways may, owing to traffic conditions, not prove a very remunerative investment, it may nevertheless be advantageous to electrify, as thereby the country served by the railway will benefit by a cheap electric supply which would otherwise be impossible. (11) In industrial areas where electricity is largely needed for manufacturing purposes the electrification of railways may enable the cost of generation and distribution to be decreased, to the general advantage of the district. (12) Economy may be gained by the decreased cost of maintenance of rolling stock and structures due to the absence of the corroding influences of smoke and steam. (13) Electrification may be resorted to for the conservation of coal, regardless of whether it is in itself financially advantageous or otherwise.—London *Times Engineering Supplement*, May, 1919.

Installations, Systems and Appliances

Electrically Driven Ship Auxiliaries.—Electric drive for deck winches, capstans, anchor windlass equipment and electrically driven steering gear are discussed with special reference to the type of motor best suited to the work and the proper control of such motor.—London, *Engineering*, May 16, 1919.

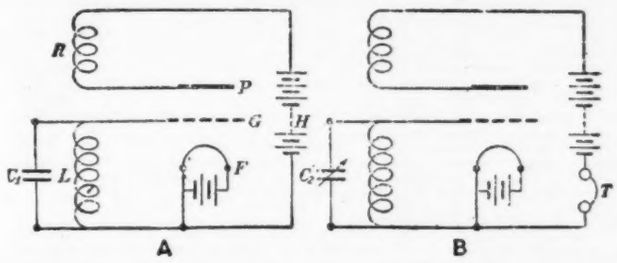
Controlling the Propulsion of the New Mexico.—H. FRANKLIN HARVEY, JR.—Details of control wiring and apparatus may be found in this article. Because of the fact that every part of the equipment is liable to damage an elaborate scheme of interconnection for obtaining a direct-current supply at the switchboard for turbine generator excitation is in use. The parts of the equipment, their arrangement and the sequence of operations in starting and reversing are fully described in this article.—*General Electric Review*, April, 1919.

Motor Equipment of United States Army Engineer Corps.—Devices exhibited in the Victory loan parade in New York City demonstrated the great flexibility of the motor truck as a tool and suggest similar adaptations in civil pursuits. Such equipment might easily be of service on any widely scattered construction or maintenance operation, where it would be advantageous to make repairs *in situ*, rather than convey the part to and from the machine shops. Portable carpenter, machine, blacksmith and printing shops were exhibited. Portable tool shops and sleeping quarters for small maintenance and construction gangs are also suggested. —*Engineering News-Record*, May 29. 1919.

Testing of Permanent Magnets.—J. D. MORGAN.—The writer outlines the tests that should be made of permanent magnets to insure their character and explains the operation of instruments with which the tests may be made.—London *Engineering*, April 25, 1919.

Units, Measurements and Instruments

A New Capacity Meter.—J. SCOTT-TAGGART.—A description of an instrument which is capable of rapid and exceedingly accurate measurement of capacity, suitable for laboratory and commercial use. If an alternating current be superimposed on another one of different frequency, the resultant current will not have a constant amplitude, but will at regular intervals increase and decrease as the two currents come in and out of phase with one another. The frequency of the increases or beats is equal to the difference between the frequencies of the two currents. The same rules apply to continuous oscillations as to alternating current. If the frequencies of the component sets of oscillations were 750,000 and 780,000 respectively, the beat frequency would be 30,000 per second. By keeping the frequency of one set of oscillations constant and varying the other set, beats of any desired frequency may



CONNECTION DIAGRAM FOR NEW CAPACITY METER

be obtained. Let these two individual currents be separately passed through the telephone receiver. They would not affect it on account of the high frequency. If they are passed through the receiver at the same time, the beat will be heard in the telephone receiver when the difference between the two frequencies goes below 14,000. In the apparatus designed by the author provision is made for an oscillating circuit at a frequency which may be altered by means of a variable condenser. Another circuit is arranged which also oscillates continuously at a frequency determined by the capacity of the condenser it is desired to test. Telephone receivers are inserted in the circuit as shown in the figure. There will be two superimposed sets of oscillations in the first circuit, and beats will be produced which when rectified will give a note in the telephone, provided the frequency is within the proper limits. Now let a standard condenser of known capacity be placed in the second circuit, which will then oscillate say at a frequency of 400,000. If the variable condenser which controls the frequency of the oscillations in the first circuit be adjusted gradually, a high note will be heard in the telephone receivers when the frequency of the oscillations is about 410,000. If the condenser be gradually turned round further, the note heard will become lower and lower as the difference between the two separate frequencies becomes less. When the frequency of the first circuit is adjusted to 400,000, no beats are produced, and nothing is therefore heard in the telephone. The capacity of the condenser under a test may thus be compared with the standard condenser.—London *Electrician*, April, 1918.

Telegraphy, Telephony and Signaling

Unidirectional Transmitting System. — The usual rectangular loop antenna radiates electric waves which may be described by the figure 8, giving maximum power in the plane of the loop and in both directions. It is proposed to mount another loop which will make the antenna most effective in one direction only, instead of two.—*Wireless Age*, June 19.

Transmission Maintenance Testing.—It is obvious that if a telephone system is to give the service for which it was designed some means must be taken to determine that it is properly constructed and properly maintained. Apparatus of two types has been standardized by the Pacific Telephone & Telegraph Company for measuring the transmission losses of telephone apparatus and circuits under actual service conditions. These are known as the transmission measuring set, which is portable, and the transmission measuring unit, which is a desk set. These have been installed in the San Francisco office, and it is also planned to put them in Los Angeles, Portland, Seattle and Spokane.—*Pacific Telephone Magazine*, May, 1919.

Wireless Telephone Transmitter for Sea Planes.—The telephone transmitter developed by the American Marconi Company for navy use during the war for flying boats, type SE-1100, is described.—*Wireless Age*, June, 1919.

Vibrations in Buildings Due to Electrical Machinery.—A. B. EASON.—This article describes some of the conditions as regards noise and vibration existing in some post office telephone exchanges and mentions certain reports dealing with similar conditions in other buildings. It may be said that generally trouble is apparent only when the supply is alternating and is always apparent when the supply is single-phase. The vibration is due to poorly balanced machines. The noise is due to (1) windage, or the movement of rotating bodies in air; (2) alternating current, or electrical or molecular hum; (3) brushes. These noises can be examined separately by running the machines with brushes off and on and by cutting off the supply and letting the machine slow down.—*Post Office Electrical Engineers' Journal*, April, 1919.

Miscellaneous

Water-Power Survey of Japanese Government.—The work includes the reconnaissance and investigation of power sites, their available heads and the discharge of rivers throughout the country, to be continued for five years.—*Bureau of Electrical Exploitation*, Tokyo, December, 1918.

Devastated Electric Power Houses in France.—AUGUSTE PAWLOWSKI.—This article on the systematic robbery and destruction of French machinery and power houses by the German invaders is illustrated with many half-page views showing empty interiors and demolished foundations where great machines formerly stood. The destruction of the great iron and steel foundries of Longwy was of a particularly atrocious and systematic kind, little save scrap iron remaining in the five central stations where formerly electrical machines rated at almost 20,000 hp. were installed. The transmission lines leaving the power houses were torn down to add to the ruin, "before which," says the author, "it is right to uncover as before a tomb."—*Revue Générale de l'Electricité*, April 19 and May 17, 1919.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ALTERNATING VOLTAGE, WAVE ANALYSIS.

A method has been derived for the determination of the order and percentage of the various components of an alternating wave of emf., using indicating instruments and other inexpensive apparatus. A commercial form of set is being developed in which the order of the harmonic present will be given directly by scale reading, and the percentage of the same from a simple calculation. An analysis of wave form without the use of the oscillograph is a possibility which will be welcomed by many engineers.—*Leslie F. Curtis, University of Washington, Seattle, Wash.*

ARC WELDING, COVERED ELECTRODE.

In the liquid-flux process the covering melts with the electrode, forming a molten flux over the end of the electrode and over the added metal, thus protecting both from oxidation from the air. This flux, by reducing chilling, in a measure serves an annealing function; but its chief value seems to be the protection from oxidation with the accompanying brittleness and porosity caused by the reaction of the oxygen on the carbon and iron of the molten metal. The solidified flux is chipped and brushed off before building up the next layer. There are a large number of different makes of liquid-flux-covered electrodes on the market, and careful experimental work is being carried out with many well-known makes to determine their respective merits or drawbacks. The results will be published in due course.—*Welding Committee of the Emergency Fleet Corporation.*

FREQUENCY METER WITH SYNCHRONOUS MOTOR

A very accurate frequency meter has been developed which consists of a small synchronous motor such as is used in the G. E. oscillograph and of a small fly-ball governor. The motor is started by hand through gears and is run from the power supply; it has no direct-current excitation and operates entirely by armature reaction. The fly-ball assumes a definite position, depending upon the speed of the motor, and the indications are greatly magnified on a long scale. Such a scale 12 in. (30 cm.) long covers a range of only four cycles, and the pointer can be easily read to an accuracy of one-tenth of a cycle from a distance of 20 ft. (6.1 m.). The motor is provided with ball bearings and will run day and night without attention for more than three months. Several of these meters are in successful operation in the power plant with which the writer is connected.—*H. S. Baker, Hydro-Electric Power Commission of Ontario, Niagara Falls, Ont.*

GALVANOMETER, ALTERNATING-CURRENT.

An alternating-current galvanometer has been developed for use on a 60-cycle, 110-volt circuit, the field being separately excited. The working current for the bridge or other network upon which the test is being made is supplied from taps to a non-inductive resistance in series with the field winding. The current in the working circuit is therefore in phase with the field current, and the moving coil of the galvanometer is connected to the network as the detector.—*Leeds & Northrup Company, Philadelphia, Pa.*

GLASSES, EYE-PROTECTIVE.

Ultra-violet radiant energy of certain wave-lengths, such as occurs in the quartz-mercury arc and in the iron arc, is extremely injurious to the eye. Excessive brightness in the visible spectrum may also cause temporary or permanent injury, while the intense heat or infra-red radiant energy coming from molten glass or metal is also considered by some as being dangerous to the eye. Many glasses have been recommended and extensively advertised to absorb injurious radiant energy and so protect the eyes. Eighty-two samples of eye-protective glasses have been studied and their transmission curves determined (partly in Cornell University). Four different methods were used to obtain the data, viz., Hilger sector apparatus, quartz spectrograph, Lummer-Brodhun spectrophotometer and Koenig-Martens spectrophotometer.—*K. S. Gibson and H. J. McNicholas, Bureau of Standards, Washington, D. C.*

IGNITION DEVICES, OSCILLOGRAPHIC STUDY OF.

Apparatus has been arranged and numerous oscillograms have been taken of the primary and secondary current, voltage, etc., of various commercial types of magnetos, vibrating coils and other ignition devices used with gasoline engines. Tests were made under conditions approximating those in actual engine operation, with the spark plugs partly in a tank at 60 lb. (4.2 kg.) air pressure. During one part of a cycle the secondary current reaches enormous frequencies, and it may be necessary later to use a sensitive high-frequency tungsten oscillograph. It is hoped that from these records it will be possible to estimate the values of secondary inductance, resistance, capacity and energy.—*F. W. Springer, University of Minnesota, Minneapolis, Minn.*

INDUCTIVE INTERFERENCE CAUSED BY DIRECT-CURRENT RAILWAY.

A case of inductive interference with the adjacent telephone circuit has been observed from the 600-volt direct-current feeders of the Saginaw & Flint Railroad; it became aggrevated when the voltage was increased to 1200. Rather extensive tests established the fact that the disturbing element was an alternating current of approximately 1250 cycles, which was caused by the armature teeth of the 1200-volt direct-current generators supplying power to the feeders. This condition was corrected by the installation of resonant shunts across the direct-current generator terminals, which entirely eliminated the noise in the telephone circuits.—*B. E. Morrow in the N. E. L. A. Bulletin.*

INSULATING MATERIALS AT RADIO FREQUENCIES, ELECTRICAL PROPERTIES OF.

In response to numerous requests from Signal Corps officers and others, the Bureau of Standards undertook a general investigation of the suitability of insulating materials for use in radio apparatus. The work has consisted in the measurement of a large number of electrical properties of the materials, and from the comprehensive data thus obtainable in the various laboratories of the Bureau of Standards the materials become known quantities in every respect. The investigation covers mainly bakelite and similar materials of the phenol type. The tests are made on panels or sheets of the material as used in actual construction of apparatus. Special methods and laboratory apparatus, particularly for the effects of high voltages, have been developed by experimental research. The effect of high voltage at radio frequencies on a fairlead insulator and on samples of antenna twine has been determined. The determination of the electrical properties of laminated phenol materials, particularly bakelite-dilecto, bakelite-micarta, formica and condensite-celoron, is to be brought to a conclusion, with a view to a comprehensive report on the subject. The electrical properties measured are volume and surface resistivity, power loss and dielectric constant at radio frequencies, and the effects of high voltage at radio frequencies. These properties are to be measured on a large number of grades and thicknesses of the laminated materials. The effects of coloring material, kind of surface and percentage of resin will be determined. Molded materials of the same kinds are to be investigated later, and also shellac materials, hard rubber, wood, porcelain, fiber and waxes.—*Radio Laboratory, Bureau of Standards, Washington, D. C.*

KVA. METER, RECORDING.

A recording kva. meter has been developed, based upon the principle of a power-factor meter. The stationary three-phase winding with vertical axis carries currents proportional to the line currents. The moving part is provided with a three-phase potential winding. If left to itself, the potential winding turns into a position in which the stator and the rotor mmfs. strengthen each other, thus acting as a well-known power-factor meter. If now the potential winding be placed somewhat above the current winding, an axial thrust is exerted, proportional to the product of the currents in the two windings; in other words, proportional to the kva. in the circuit. This thrust is made to move a pen across a bar in a manner used in Westinghouse graphic recording instruments of the relay type. Laboratory tests have shown the instrument to be independent of the power factor and of the ampere unbalance. The definition of kva. in an unbalanced polyphase circuit that the meter registers is $(\text{kva.})^2 = (\text{kw.})^2 + (\text{reactive kva.})^2$. This meter is radically different from the one in which the kw. and the reactive kva. components are mechanically added at right angles.—*H. S. Baker, Hydro-Electric Power Commission of Ontario, Niagara Falls, Ont.*

Suggestions for Research

INSTRUMENTS, RECORDING BY MEANS OF GAS JET.

The disadvantage of an ordinary recording pen is its considerable and variable friction on paper. A recent proposal, with some successful experiments, is to use a tiny jet of gas (unignited) in place of the pen. The gas must be of such a nature as to react chemically upon the paper. This suggestion opens a fruitful field for research as to the advantages, limitations and new applications possible with this method. For first experiments see *Comptes Rendus*, Dec. 30, 1918; abstracted in *La Revue Générale de l'Electricité*, Vol. 5 (1919), p. 334.—*Editorial Suggestion.*

IRON LAMINATIONS, LOW-LOSS.

In view of the cheapness of silicon, there seems to be no theoretical reason why one should not produce high quality iron-silicon alloy having very low hysteresis and eddy-current loss at a price comparable with ordinary electrical iron. If this were done, and if the permeability at high saturations could be made as good as that of ordinary iron, the iron-silicon alloy would come into general use for large electrical machines and would result in an enormous improvement in the efficiency of electrical machines in general. This problem should be capable of solution in the immediate future if attacked by well-equipped rolling mills.—*Miles Walker, College of Technology, Manchester, England.*

TELEPHONE, AUTOMATIC, STUDY OF STEELS.

A study is desired of steel used for quick-acting electromagnets such as automatic relays and motor magnets. The term "steel" is meant to cover all magnetic irons from Norwegian iron through the various steels which have been found useful for the cores and heel pieces for relays and motor magnets. This study would be chiefly experimental, mechanical and electromechanical.—*A. B. Smith, Chicago, Ill.*

Arc-Welding Equipment

To the Editor of ELECTRICAL WORLD:

SIR: In your issue of May 31 there appeared an article under the heading "Proper Selection of Arc-Welding Equipment." In the opinion of the writer this article is very misleading on account of the fact that it recognizes only two subdivisions of direct-current arc welding, namely, high-voltage constant potential and so-called "constant energy." Reference to the writer's article of Jan. 25 will show that there are several systems that are not mentioned in this article and that of all the systems these two are of the least importance at the present time. The so-called "constant-energy" system is simply a differential machine such as is made by a half dozen different manufacturers, but in one instance where the differential machine is used as a balancer it has been given the name "constant energy," probably for commercial reasons. However, the writer has tested machines of this type and found that the characteristic is precisely what would be expected from this type of machine, namely, a falling off in voltage with an increase in current in accordance with a practically straight-line characteristic. The energy is only constant when the welder holds a constant length of arc, and under such conditions every system becomes a constant-energy system.

Statements of the kind embodied in this article are very misleading on account of the matter which they omit rather than what they include.

New York. OTIS ALLEN KENYON.

Is Electric Heating of Residences a Dream?

To the Editor of ELECTRICAL WORLD:

SIR: In the March 22 issue of the ELECTRICAL WORLD there appeared an article under the above heading by Prof. Joseph F. Merrill, director of the School of Mines and Engineering of the University of Utah, in which he refers to electric heating of residences as an alchemist's dream. Perhaps it would prove not so much of a dream if one would analyze the proposition from the practical point of view.

It is sometimes of equal importance and many times more illuminating to solve a problem by practical experience than by theoretical computation. I wish to refer to only one part of the above-mentioned article, and that is the last paragraph, in which an efficiency of 60 per cent is assumed for a furnace and upon this assumption the cost of operation for electric power is compared to coal.

In the first place, we know that an efficiency of 60 per cent for a furnace in a home is entirely out of the question and it also might be considered a dream. An efficiency of 10 per cent would be a high average. We also know that coal such as we have been getting for the past three or four years has a B.t.u. value of something less than 10,000 B.t.u. per pound of coal. We also know that the amount of unconsumed coal in the ash is at least 10 per cent of the amount fired.

$10{,}000 \times 2000 \times 0.90 \times 0.10 = 1{,}800{,}000$ B.t.u. total heat received from one ton of coal burned in the average residence furnace.

1,800,000 ÷ by 3412 = 528 kw.-hr., being the equivalent of one ton of coal.

With coal at $10 per ton as mentioned, the equivalent rate for electricity would be 1.9 cents per kilowatt-hour. However, taking into consideration the handling of coal, ashes and many inconveniences attending the operation of a coal furnace, electric heating for residences would not only be possible but become a necessity at 3 cents per kilowatt-hour in the same manner that running water in the kitchen and bathroom has become a necessity, although we know that we could have a well in the back yard and pull the water up in buckets by means of a rope at much less expense. WIRT S. SCOTT.

Manager Industrial Heating Section, Westinghouse Electric & Manufacturing Company.

Readers' Views and Comments

Efficiencies of Boiler and Stoker

To the Editor of ELECTRICAL WORLD:

SIR: The letter of T. A. Marsh, published on page 1045 of the ELECTRICAL WORLD of May 17, 1919, invites some comment and a considerable amount of criticism. The following statement of the last paragraph, "Engineers are therefore recommended to analyze all results and to reduce efficiencies to a basis of net rather than gross," seems to reflect in an entirely unwarranted manner upon the intelligence, foresight and judgment of the engineers who are designing the big steam-power generating stations of the country to-day. It assumes that properly intelligent study is not being made by designing and consulting engineers of factors which, as a matter of fact, are studied in far greater detail and scope than merely considering the "net" or "gross" efficiencies of boiler and stoker combinations.

A study of the modern stations, for instance, shown on pages 984, 1003, 1015, 1017, 1020, 1021 and 1022 of the issue of the ELECTRICAL WORLD in which Mr. Marsh's letter appears will show that in practically every one of the stations illustrated the type of stoker installed is that which Mr. Marsh refers to as requiring more power for auxiliaries than some other types. The answer is simple—because a careful study of all of the factors entering into the selection of the station equipment has convinced the engineers who designed these stations that with this type of stoker "operating costs" will be lowest and total cost per kilowatt-hour will be cheapest. They find, in studying all of the factors concerned, for instance, that with this type of stoker it will be possible to obtain continuous overload capacities with a given size of boiler, which would be out of the question with stokers of the type which Mr. Marsh describes as "requiring only a small fraction of 1 per cent of the total steam generated for their operation." This, of course, means smaller rated boiler capacity needed to meet the steam requirements of the station—and consequently a smaller building to house the boiler equipment—all at a greatly reduced cost for building and land, and greatly reduced interest on investment. A few per cent more power for operation of auxiliaries may amount to very little compared to the saving thus effected.

Again, engineers operating these stations have found that, in spite of increased power required for operation of auxiliaries, it is entirely possible to obtain net combined efficiencies of boiler and stoker with this type of stoker which are far above those obtainable with stokers requiring a smaller percentage of power to be generated for their operation. Engineers have also found by experience that with the type of stokers which have been installed in practically all large steam generating stations in recent years it is possible to handle load fluctuations, with no appreciable loss in efficiency, which may vary from 100 per cent to 600 per cent of rating for given units with ease and within a few minutes' time, whereas with some types of stokers this would be entirely impossible and would require cutting in boilers operated on banks for the purpose of meeting such load fluctuations.

Regarding the amount of steam used for the purpose of preventing clinker formations on side and bridge walls, Mr. Marsh's statement is quite misleading, as in no case of actual operation would this amount to probably more than one-tenth of 1 per cent of the steam generated. The stoker equipment for most of the modern steam generating stations throughout the country has been selected because a study of all factors entering into the cost of construction, operation and maintenance of the entire plant has proved that the net cost of producing power would be least with the type of stoker selected—the type which admittedly does use a slightly larger percentage of the total steam generated for its operation. The amount required for the operation of stokers and auxiliaries may be an insignificant item as compared to economies made possible in other ways by the use of the type of stoker in question.

E. W. WAGENSEIL.

Stoker Section, Westinghouse Electric & Manufacturing Company.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SUMMER MEETING OF THE ASSOCIATED MANUFACTURERS

Gatherings of Sections at New London, Conn., This Week Are Supplemented by Evening Sessions—International Trade Progress

Meetings of the Associated Manufacturers of Electrical Supplies at the Hotel Griswold, Eastern Point, New London, Conn., on Monday, Tuesday and Wednesday of this week, were devoted largely to the sessions of sections. Two general meetings were held, however, on Monday and Tuesday evenings at which all of the members gathered. The first was of a business character and was devoted mainly to the work of the international trade committee. The second was an entertainment session and C. B. Eveleth, General Electric Company, told of the accomplishments in detecting submarines during the war.

Meetings of the sections, which were the principal purpose of the gathering of members, were held according to the schedule printed previously in the ELECTRICAL WORLD. They were well attended. The attendance reached a total of about 175.

President A. W. Berresford opened the Monday evening session with a short discussion of the form of organization which has been effective. He regards the function of the board of governors as supervisory. It is desired to have the action taken represent the average point of view of the men who are doing the everyday work of the industry.

Charles E. Dustin, the general secretary, then arranged the schedule of hours for the various section meetings.

The international trade committee had held a meeting in the afternoon but wanted to present at an evening session for all of the members a number of the matters which it is considering. John J. Gibson, Westinghouse Electric & Manufacturing Company, chairman of the committee, went over in some detail the activities of the committee since its last general report to members. He spoke of the imminence of tariff revision and said that the subject should have the very serious thought of all members. Members should be prepared to appear before the ways and means committee of the House of Representatives in order to present the conditions in the production of their materials upon which they ask for tariff protection.

Reference was also made by Mr. Gibson to the costs of manufacture of electrical materials in foreign countries. He said that the members should prepare to give statistics to Congress on the extent of the industry, and expressed regret that more information has not been made generally available before as to the real size of the large output of electrical manufacturers.

Mr. Gibson showed the importance of statistics to tell the number of employees and the amount of capital used in the industry, not only as totals but also divided according to the various well-defined branches. He also mentioned the question of the development of export trade, another part of the work of the committee.

William Burgess, expert adviser of the committee, outlined the progress made in the compilation of data for the use of the committee. He said that the matter of tariff protection of American industries is of more vital interest than ever before in the history of the country. In referring to the data desired to show the labor content in the cost of electrical supplies he said that it should be borne in mind that the raw materials from which these supplies are made have also a large element of labor cost. Another matter that should be settled definitely, said Mr. Burgess, is that of requesting a separate schedule for electrical machinery and supplies in the tariff act.

In presenting the case of the electrical manufacturers to Congress, said Mr. Burgess, it is desirable to give as full and accurate a statement of facts as is possible to obtain. In addition to the capital actually invested, the annual output in value, the number of persons actually employed and those directly and indirectly dependent on the industry for a living, there should be stated the wide territorial spread of the plants, the great variety of materials used in the process of manufacture, the number of states engaged in furnishing the materials, relation of the industry to the economic and social welfare of all the people, etc.

The Electric Power Club members are coöperating in tariff matters, following the same lines of inquiry as those which are being developed for members of the Associated Manufacturers of Electrical Supplies.

Mr. Burgess gave some statistics of the extent of the industry in 1914, based on the manufacturers' census. The classification does not include those parts of the industry included under the classification "iron and steel and products" and "metals and metal products" or under "gas and electric fixtures, lamps and reflectors." According to the statistics given the number of establishments engaged in the manufacture of electrical machinery, apparatus and supplies ranked as follows in comparison with other industries with gross products in excess of $100,000,000 but less than $500,000,000:

Average number of wage-earners	14
Value added by manufacture	16
Value of products	19
Cost of materials	23

Mr. Burgess made an appeal to the members to furnish accurate statistics up to date. He feels that the 1914 statistics, which as shown are incomplete, are an inaccurate presentation of the scope of the industry. These statistics indicated 1030 establishments, with 144,712 individuals engaged, $355,724,756 capitalization, $109,097,610 salaries and wages, $154,728,076 cost of materials and $180,442,118 value added by manufacture. Based on such incomplete statistics as have been obtained, the industry has increased several fold in the last five years.

Figures were given by Mr. Burgess to show the number of raw materials entering into products of the industry. There were 58 different kinds of minerals and chemicals, 8 of water, 5 of oil, 34 of metals, 18 of rubber and composition, 9 of paper, 13 of cotton, wool or silk, 11 of paint and varnish, 4 of wood and 21 of miscellaneous, a total of 181.

Considerable discussion then followed on the subjects brought up by the committee. Mr. Berresford spoke of the mine cost and mill cost back of raw materials as large elements in the total cost before they reached the electrical manufacturers. The discussion was directed toward the necessity of awakening the manufacturers individually to the importance of giving close attention to tariff matters.

E. F. Wickwire, Ohio Brass Company, chairman of the export sub-committee of the international trade committee, spoke on the work done to develop export trade. He said that the difficulty with manufacturers in the past had been that when times were good they were too busy to give attention to export trade and when times were hard they were too poor. They are now getting interested, however. Mr. Wickwire then spoke of the reasons for the proposal to form an organization or association to undertake investigations into export trade possibilities, working along research lines. This plan is mentioned in an article printed in this issue of the ELECTRICAL WORLD.

Thomas M. Debevoise, general counsel of the association, then discussed briefly the recent decision of the United States Supreme Court in the Colgate case and spoke generally of the aims of the manufacturers in the Associated Manufacturers' organization.

On Tuesday evening no business was transacted. President Berresford introduced Mr. Eveleth, who gave an illustrated talk on the development of submarine detection during the war. He told of the detail of engineers of the company, including himself, who conducted experimental work at Nahant, Mass., and then of the more dangerous work in the North Sea.

PLAN OF THE MANUFACTURERS FOR EXPORT RESEARCH WORK

Organization or Association Is Proposed to Make Studies of Foreign Trade Possibilities and Matters of Credit, etc.

A plan for the organization of an export research organization or association to represent electrical manufacturers is under consideration. A brief announcement in regard to it was made at the meeting of the Associated Manufacturers of Electrical Supplies at New London, Conn., this week. John J. Gibson, chairman of the international trade committee, and E. F. Wickwire, chairman of the export sub-committee of that committee, have been appointed by the committee to take up the matter with the manufacturers of electrical apparatus. Mr. Wickwire, in referring to the subject at one of the sessions at New London, said that the purpose is to see if the manufacturers of electrical supplies can be brought together with the manufacturers of electrical apparatus in a movement to develop the export trade markets in both classes of materials.

Under the proposed arrangement an organization or association would be formed which would conduct what might be termed research work of a commercial and financial character. It would not be a buying and selling agency. It would not be organized under the Webb-Pomerene act. It would conduct investigations into the possibilities of markets for manufacturers and into matters of credit.

THEODORE N. VAIL TO BE CHAIRMAN OF THE BOARD

H. B. Thayer Will Become President of the American Telephone & Telegraph Company—John J. Carty to be Vice-president

Theodore N. Vail, president of the American Telephone & Telegraph Company, announced on Wednesday a reorganization of the corporation and important changes in personnel preparatory to the return of the wires to private control. The changes, he said, would enable the company more effectively to meet the problems of the reconstruction period. Under the new system Mr. Vail will become chairman of the board of directors and will thus be able to devote his attention to the larger problems of the business. He will continue to be in active direction of the policy and problems of the company.

H. B. Thayer, who has been identified with the system for forty years in both manufacturing and administrative capacities, has been made president. N. C. Kingsbury, who has been concerned with both operation and public relations, has been designated first vice-president. N. T. Guernsey, the general counsel, has been named vice-president in charge of the legal department. John J. Carty, who has long been head of the research, experiment and development work, is to be vice-president in charge of development and research. W. S. Gifford, also long connected with the company, and who since resigning as director of the Council of National Defense has been comptroller of the company, has been made vice-president in charge of accounting and finance. Bancroft Gherardi, for many years Mr. Carty's chief aid and who has been acting chief and engineer during the period of Mr. Carty's war service, has been appointed chief engineer.

Vice-president Bethell, who has been in charge of the federal operating board, was invited to rejoin the organization, but as he wished to take a long rest he declined.

Mr. Vail's statement pointed out that these changes were in titles rather than function. The statement said that the readjustments were necessary in view of the great development in the art of transmission of intelligence by electricity, particularly the great development in multiplex telephony, machine operation of both telephone and telegraph and wireless telephony.

Effect of Daylight Saving on White Mountain Central Station

The Bethlehem (N. H.) Electric Company supplied 33,798 kw.-hr. in the season of 1916 to sixteen of the larger hotels in the upper White Mountain district, this being a normal year with no price changes or other disturbing features. In 1918 these same hotels, under the same management, and with daylight saving in effect, purchased 21,948 kw.-hr. from the Bethlehem company.

A. W. BERRESFORD ON EUROPEAN CONDITIONS

Much Misunderstanding in This Country and England as to International Trade, and British Attitude Should Have Due Consideration

A. W. Berresford, vice-president and general manager of the Cutler-Hammer Manufacturing Company, Milwaukee, and president of the Associated Manufacturers of Electrical Supplies, returned to this country recently from a short trip to England. It was taken in reference to matters concerning the Igranic Electric Company, Ltd., which is controlled by the Cutler-Hammer Manufacturing Company.

Mr. Berresford did not cross from England to the continent, but his visit gave him an insight into conditions of Europe as a whole which will be of interest to manufacturers in this country. He was asked to give his views on these conditions to the ELECTRICAL WORLD. He believes that there is much misunderstanding in both this country and England as to the factors which affect international trade and competition between the two countries. As an example of this, Mr. Berresford called attention to a recent advertisement of an English manufacturer in the London *Electrician;* part of this is reproduced here. He further stated that he had naturally expected to find in England a more exaggerated situation than that prevailing here. The relief from the strain under which England has labored during the past four years must, in his opinion, be evidenced in some form, and the expression might easily involve the elements of hysteria. This seemed somewhat in evidence in labor conditions.

The workers of the country, at the request of the government, had abandoned for the period of the war their policy of restrictions on output, with the understanding that they were to be reëstablished at its termination. The entire productive facilities of the country had been employed on war work, and the results of the cessation of this demand were consequently by far more serious than in this country and the difficulty of return to normal lines of output by far greater, with a consequent increase in the duration of the period required.

"Rather naturally, from the standpoint of human nature, the men have seen little reason for an apparent delay in readjustment and have become impatient, and all manner of doctrine is receiving ready acceptance, although most of it is at distinct variance with economic considerations," said Mr. Berresford. "The trained and experienced leaders of the workers realize conditions and urge patience and conservatism, but the demagogue is for the moment more influential, and demand after demand appears embodying every variety of claim, from simple requests for wage increase to equal participation in management and nationalization of entire industries.

"Furthermore, the government is paying 'out-of-work benefits' to nearly a million workers, and this does not appear to be productive of good, as it is claimed

MADE IN ENGLAND, OR MADE IN U.S.A.?

To make it in England would necessitate our laying out about £10,000 in press tools and equipment to manufacture.

Would you lay out even £10 of your money on a proposition which under present free trade conditions would work out as follows :—

1ST YEAR.	We lay out £10,000 of hard-earned money. Start factory, employ British labour, turn our articles equal in every respect and at same prices as American product.
2ND YEAR.	Americans will undoubtedly cut their prices. We do ditto.
3RD YEAR.	Americans cut under us again. We cannot reduce price without loss. (Americans can *always continue to cut lower than we can*, as they are making double or treble the quantity, having their own tariff-walled market *and* our free trade market to sell in.)
4TH YEAR.	We are compelled to shut down factory, discharge British workers, and lose our £10,000.
5TH YEAR.	Americans having killed competition (by aid of the advantage they have working under tariff conditions), up go their prices far above even their first year's price.
RESULT.	We loose our £10,000. British workmen unemployed. Consumer is paying more for the article. Profits are taken by foreigners. Factories are enlarged in foreign countries.
REMEDY.	Tariff Reform. That is, reciprocal tariffs, further adjusted to compensate for different rates of labour in the different countries.

A good deal of publicity has at one time and another been given in our English Electrical papers to American-made goods, and whilst the American product was no doubt worthy of praise, an article as good or better can be made here, and will be, as soon as the conditions of manufacture are made fair to the British makers.

The above are *our* views, and the reason why we don't care to put money into the scheme.

We want to make this apparatus. We could be selling it in three months from starting.

Can you prove to us where our argument is wrong ? If so, will you immediately write us ?

So many of our friends have suggested we make these articles, that this statement is chiefly to show why we are absolutel prevented from starting.

It's not for want of pluck on our part ; we'll compete with anybody under fair trade conditions.

We think, however, it would be sheer madness for us to put our money in it under free trade conditions

There are 500,000 unemployed in this country at the present moment (*Sir Eric Geddes*)

GIVE THEM A JOB.

THIS IS FROM AN ADVERTISEMENT OF AN ENGLISH MANUFACTURER IN A LONDON ELECTRICAL PAPER

that the recipients would rather idle on the amount so received than work for a somewhat greater return.

"Under these conditions, the factor in the situation which occasioned real surprise does not seem so unreasonable. Reference is made to the fear on the part of the British manufacturer that America will not merely be a competitor for world trade but will invade England and actually absorb the Englishman's home market. This belief finds expression in the insistence that the government at least limit imports and even forbid them in certain lines of product, notably those involving metal trades.

"To offset the demands for increased compensation so as to provide a better living standard, employers are pointing out that this is possible only if justified by production; otherwise compliance means the death of British industry and the delivering of British markets to competitive nations.

"The immediate effect of this is to place a premium on British manufactured goods, and for the immediate future at least import into Great Britain will be accomplished with increasing difficulty. No attempt is made to pass on the economics of the situation, but the attitude of the British manufacturer is at least a human one, and while a solution will be found ultimately, it would seem that the finding of it will be hastened if this attitude is appreciated and given due consideration.

"The United States is undoubtedly more fortunately placed at the moment, owing to its lateness in entering the war, and there is at least a doubt if the ultimate good of all will be served by too great insistence on this advantage at this time.

"The policy of France at the time appeared to be definite in the decision to permit no preventable importation and in effect to carry on her own reconstruction work. Lately this appears to have been modified to some extent, provided that exceedingly long credits are granted, say two or three years, and at least a possibility of importation is thus provided; but it should be remembered that the transportation facilities of northern France have been practically destroyed and economical rehabilitation must be to a large extent contingent on their restoration.

"Spain is becoming active in the improvement of her copper and iron resources, and England is naturally pushing her trade there."

Asked as to readjustment conditions in this country, Mr. Berresford expressed himself as in agreement with the large majority of American manufacturers in favoring the minimum of government connection with the country's activities. He believed that the return toward stable conditions would be delayed by any interference with the natural trend of events. He felt that but little reduction in prices of finished products would come in the near future from the operation of natural laws, pointing out that inflation and the consequent reduced purchasing power of the dollar rendered present and pre-war prices practically equivalent.

Mr. Berresford did not believe that for the average concern the moment was opportune for extended planning for the extension of European trade, especially so far as the warring nations were concerned, but felt that the situation should be carefully and competently studied and plans evolved which a year or two from now would come to fruition and form the foundation for a continuing relation helpful to both parties to the bargain.

EQUIPMENT MANUFACTURERS DISCUSS WORKING PLANS

Makers of Material Handling Apparatus Hold Semi-Annual Meeting—To Educate Public as to Need for More Labor-Saving Devices

The Material Handling Machinery Manufacturers' Association meeting at the Hotel Astor, New York City, on June 10 and 11 laid plans for a nation-wide educational campaign to bring home to manufacturers and the public at large the need for further development in the use of labor-saving devices.

Coöperative advertising through the medium of motion pictures will be a feature of the campaign as outlined at the preliminary meeting on June 10 of the advertising managers of the concerns represented. An advertising council was also formed to join with Zenas W. Carter, the association's secretary-manager, in this work. The object will be to stimulate interest in mechanical handling devices generally rather than in any one appliance in particular. E. B. Hill, McGraw-Hill Company, briefly outlined a tentative advertising campaign and suggested that the association adopt a trademark. Others who spoke advocating coöperation among manufacturers were Burdette Phillips, Burdette Phillips Company, and G. M. Van Harlingen, Republic Motor Truck Company.

At the morning session on June 11 President Calvin Tomkins outlined the association's program, declaring that it faced an unequaled opportunity to demonstrate the effectiveness of coöperative publicity. The association must prove to labor as well as capital that more extensive use of mechanical appliances would increase productivity and be a benefit to all concerned, he said.

Among those who spoke at the afternoon session were James H. Collins, writer on industrial subjects; Francis Holly, director of commercial economics, Washington, D. C., and David B. Rushmore, General Electric Company, who declared "that the association's plans were of special interest to the electrical industry." Since most mechanical handling appliances are electrically driven, adoption of such equipment at terminals and in factories would, he thought, materially increase the central stations' load.

At the evening session ex-Senator Theodore N. Burton spoke on "Extension in Port and Terminal Facilities as the Determining Factor in the Success of the American Merchant Marine."

ASSOCIATION OF EDISON COMPANIES WILL MEET

Convention to Be Held at New London, Conn., Sept. 15 to 18 Will Renew Activities Suspended for Period of the War

The Association of Edison Illuminating Companies will hold a meeting at the Hotel Griswold, Eastern Point, New London, Conn., on Sept. 15 to 18. This meeting will mark the renewal of the important activities of the association after suspension of the work during the war.

Notice of this meeting follows the announcement of resumption of activities of other associations in the industry, as printed in recent issues of the ELECTRICAL WORLD.

ARKANSAS INTERESTED IN INTERCONNECTION PLANS

Electric Power to Be Large Factor in Developing Resources Under Commission Regulation—Economics Are Also Discussed

While the papers and discussions at the annual convention of the Arkansas Utilities Association at Fort Smith, Ark., June 10, 11 and 12, contained few direct references to utility conditions in Arkansas, there was apparent an undertone of optimism that was unmistakable. All four of the principal groups of properties in the state were represented at the meeting, and a few men were there from other plants. It was among the men from the companies that aspire to become more than "single-town outfits" that it was easiest to detect this confidence in bright prospects. Interconnection, extension, electrification of heretofore virgin territory and kindred subjects are the topics of hotel lobby conversation at gatherings of Arkansas public utility men now; and these are the topics which represent the real interest of the industry in that state more than do the convention papers of the twelfth annual meeting.

The prearranged convention program consisted of six papers as follows: "Transmission-Line Construction," by William Crooks, engineer for the Arkansas Light & Power Company, Pine Bluff; "Incandescent Lamps," by George B. Walker, St. Louis; "Application and Operation of Light-Weight Safety Cars," by A. L. Faber, St. Louis; "Elements of Rate Making," by F. A. Whitlaw, manager the Pine Bluff Company; "Advertising and Publicity," by T. A. Wright, Little Rock, and "Insulation of Distribution Transformers," by A. C. Farmer, East Pittsburgh, Pa. Mr. Crooks in his paper discussed the standards of construction which his company uses in building 33,000-volt lines. Mr. Whitlaw explained methods of making equitable rates and methods of explaining these rates to the public so that they might be understood. Mr. Wright told how the proper and continuous use of publicity in Little Rock had retained the good will of the community at a time when war's demands on the company's service might otherwise have made the public antagonistic.

NEW ARKANSAS COMMISSION

In the open discussions other subjects were broached. All utilities expressed interest in seeing that the new Arkansas Corporation Commission, which has just begun to regulate utilities, should secure whatever coöperation from the companies it might desire. To assist in this committees from the association were appointed to work with the commission. L. W. Helmreich, Little Rock, chief engineer of the commission, who attended the meeting, voiced the intention of the commission to do justice to both the utilities and the public. As another matter of legislative interest President D. C. Green, Fort Smith, stated that the legislature which had just ended had not enacted a single law antagonistic to capital. He advised utilities to adopt a platform of asking a fair replacement value for their business in cases before the commission but spoke strongly against abusing the rights which the new commission law gives. At the suggestion of J. S. M. Wharton of Helena, a committee was formed to see if some uniform and fair plan of taxing could not be discussed with the state tax commission.

Officers elected for the ensuing year are: President, J. S. M. Wharton, Helena; first vice-president, J. L. Longino, Pine Bluff; second vice-president, P. T. Phillips, Little Rock; secretary-treasurer, W. J. Tharp, Little Rock. Class B members, the salesmen, elected officers as follows: President, H. J. Bonenkamp, St. Louis; vice-president and chairman entertainment committee, Walter Springe, St. Louis; secretary-treasurer, L. E. Fuller, St. Louis.

JOHN I. BEGGS OF MILWAUKEE BUYS ARKANSAS UTILITIES

Milwaukee Utility Man Secures Control of Transmission Company Serving Coal-Producing Regions in Southwest

John I. Beggs, Milwaukee, has purchased control of the Commonwealth Public Service Company, which has headquarters at Fort Smith, Ark., from a firm of Chicago bankers. This company, operating gas and electric properties in eastern Oklahoma and western Arkansas, has as its principal property a transmission company that buys power from the Fort Smith (Ark.) Light & Traction Company to distribute to ten towns and to a group of thirty-four coal mines and eight cotton gins. These towns are Alma, Dyer, Mulberry, Ozark, Altus, Alix, Denning and Hartman, where energy is sold at retail, and Clarksville and Coal Hill, where wholesale power contracts exist. The total population of the group is 15,000, and districts are known as the Denning, the Spadra and the Jamestown fields. In addition to this, the company owns gas plants at Prior, Wagner, Choteau, Vian and Salina, Okla., and Alma, Ark., and ice and electric plants at Mena, Duqueen, Ashtown and Vian, Okla., and an ice plant at Salisaw.

The company will continue to operate under the name of the Commonwealth Public Service Company. Its officers are: President, John I. Beggs, Milwaukee; first vice-president, Dick R. Lane, Davenport; vice-president and general manager, G. W. Fry, Fort Smith, and secretary-treasurer, C. O. Reynolds, Chicago.

OMISSION IN 1918 EDITION OF NATIONAL ELECTRICAL CODE

Second Paragraph of Rule 23a, Appearing in 1915 Edition, Inadvertently Omitted but Still Applicable

In the 1915 edition of the National Electrical Code the second paragraph of Rule 23, Section a, read as follows:

"Where the switch required by No. 24a is inside the building, the cut-out required by this section must be placed so as to protect it, unless the switch is of the knife-blade type and is inclosed in an approved box or cabinet, under which conditions the switch may be placed between the source of the supply and the cut-out."

Through an error this section was omitted when the 1918 edition was printed.

The electrical committee of the National Fire Protection Association has voted that the matter be given the widest publicity in order that all interested parties may be advised that this section was inadvertently omitted and is still applicable.

ILLUMINATING ENGINEERING SOCIETY ELECTS OFFICERS

S. E. Doane Will Be President in 1919-1920—Officers for the Four Geographical Sections Are Also Chosen at June Meeting

The election of the following officers of the Illuminating Engineering Society for the fiscal year 1919-1920 was confirmed by the council on June 12, 1919. They were elected to fill the offices made vacant by expiration of terms:

President—S. E. Doane.
Vice-president—William J. Clark.
General secretary—Clarence L. Law.
Treasurer—L. B. Marks.
Directors—E. C. Crittenden, F. E. Cady and R. B. Ely.

S. E. DOANE

The membership of the council for 1919-1920 will therefore be as follows: S. E. Doane, president; G. H. Stickney, junior past-president; George A. Hoadley, junior past-president; William J. Clark, vice-president; H. A. Hornor, vice-president; Otis L. Johnson, vice-president; H. K. Morrison, vice-president; Clarence L. Law, general secretary; L. B. Marks, treasurer; Adolph Hertz, S. C. Roger, P. S. Young, John C. D. Clark, Evan J. Edwards, James J. Kirk, E. C. Crittenden, F. E. Cady and R. B. Ely, directors.

The election of the following section officers was also confirmed:

New York Section—Chairman, F. M. Feiker; secretary, R. E. Harrington; managers, W. T. Blackwell, W. J. Clark, L. J. Lewinson, J. P. Ladcliffe, Jr., and G. A. Sawin.

Philadelphia Section—Chairman, G. Bertram Regar; secretary, H. B. Anderson; managers, H. Calvert, C. E. Clewell, R. B. Duncan, Howard Lyon and W. L. Nodell.

New England Section—Chairman, H. F. Wallace; secretary, H. W. Jordan; managers, G. N. Chamberlain, John C. D. Clark, J. W. Cowles, Raymond A. Fancy and F. A. Gallagher, Jr.

Chicago Section—Chairman, F. H. Bernhard; secretary, E. D. Tillson; managers, A. L. Arenberg, F. F. Fowle, E. H. Freeman, James J. Kirk and J. L. Stair.

Samuel E. Doane, the new president of the Illuminating Engineering Society, is chief engineer of the National Lamp Works of the General Electric Company. Mr. Doane was born at Swampscott, Mass., on Feb. 28, 1870. He was associated with the Thomson-Houston Company, Lynn, Mass., from 1886 to 1892, working four nights each week on the testing force and in the laboratory and rising from office boy to acting engineer and assistant foreman of the incandescent lamp department. When the lamp department at Lynn was shut down in 1892 because of the financial panic in that year all the employees were released with exception of Mr. Doane, who was transferred to the plant at Harrison, N. J. He served with the General Electric Company from 1892 to 1897 as assistant engineer, superintendent of the Harrison Lamp Works and later as acting engineer of the foreign department at Schenectady. From 1897 to 1900 he was superintendent of the Bryan-Marsh Company at Marlboro, Mass.

ILLUMINATING ENGINEERING SOCIETY TO MEET IN CHICAGO

Annual Convention Will Be Held in That City on Oct. 20 to 23 Inclusive, and an Excellent Meeting Is Anticipated

The 1919 convention of the Illuminating Engineering Society will be held at the Hotel Sherman, Chicago, on Oct. 20 to 23 inclusive. The chairman of the 1919 convention committee is Homer E. Niesz. William A. Durgin is the vice-chairman and Edwin D. Tillson the secretary.

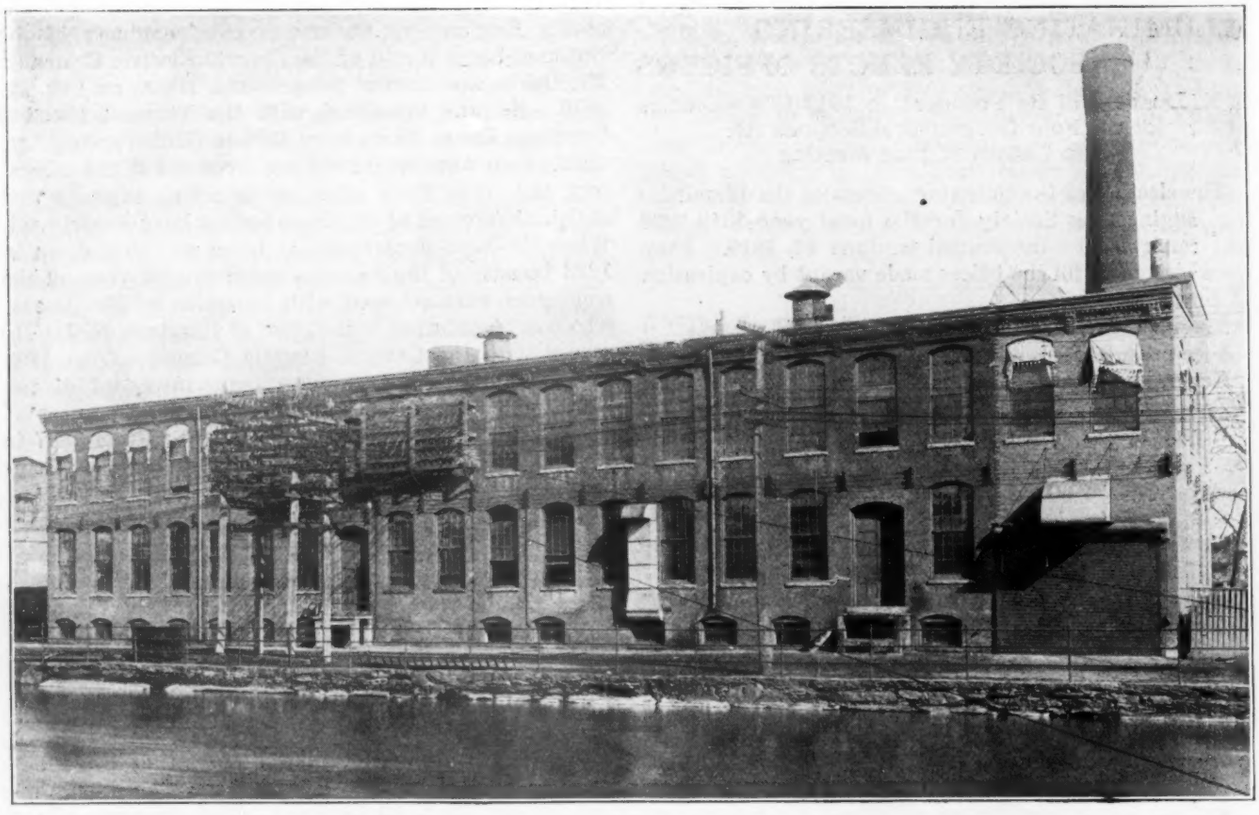
No definite program plans have been formulated as yet, but it is expected that the joint work of the program and convention committees will result in an excellent meeting.

A CHICAGO MAN HEADS ELECTRICAL CREDIT MEN

National Association Protects Members from Poor Credit Risks—Bad Accounts Decreased in Number and Amount Compared with 1918

Members of the National Credit Association have shown their appreciation of the benefits they are deriving from the organization by increasing the per capita dues levied upon the five local associations for the support of the national body. This action was taken at the twentieth annual meeting of the association at Cincinnati last week. During the past year the total number of names of slow or otherwise unsatisfactory customers reported to the local associations of Boston, New York, Philadelphia, Chicago and San Francisco was 167,758. Both in number and in amount involved there was an average decrease of 30 per cent in bad accounts compared with the preceding year and a decrease of more than 50 per cent compared with the totals of 1915.

The election of officers for the ensuing year resulted as follows: President, Benjamin P. George, Beardslee Chandelier Manufacturing Company, Chicago; vice-president, George J. Murphy, Pettingell-Andrews Company, Boston; general secretary-treasurer, Frederic P. Vose, Chicago; assistant secretary-treasurer, Walter S. Vose, Chicago.



IMPORTANCE OF CHEAP POWER IS DISCUSSED AT HOLYOKE

Proposition of Hydroelectric Company Considered at Hearing Upon Future Policy of Municipal Plant in That City

Leading manufacturers and business men of Holyoke, Mass., manifested a great interest in the proposed contract of the municipal lighting plant with the Turners Falls Power & Electric Company at a public hearing June 11 called by the Chamber of Commerce to discuss the future policy of the city's station. An outline of the situation confronting the plant was published in the ELECTRICAL WORLD for June 14, page 1286. President J. H. Potts of the Chamber of Commerce occupied the chair and stated to the 200 citizens present that the proposition was the most important question that had arisen in municipal affairs in the past twenty years. He urged that hasty action be avoided by a careful and thorough consideration of the situation.

John J. Kirkpatrick, manager of the city lighting department, stated that the Holyoke plant contains about 13,000 hp. in steam-driven and 1000 hp. in water-driven generators. The proposition is the result of a suggestion of the Fuel Administration made in the fall of 1918, calling attention to the advisability of utilizing water power to save coal and intimating that a tie-in between the Holyoke municipal plant and the Turners Falls system might be mutually advantageous. Within a few miles of Holyoke are the municipal plants of South Hadley, Chicopee and Westfield, which purchase all their electrical energy. Mr. Kirkpatrick said that he submitted the company's proposal to the city authorities as a matter of duty and that he made no apologies for his letter of transmittal, in which he emphasized the general advantages of the terms offered the city. He stated that in his opinion the contract might be amended in some particulars.

W. T. Sawin of the Holyoke Water Power Company said that his plants had about 1000 hp. in reserve at present which is available for the city's use, and that the company had furnished the city with water power to save coal or to maintain the full volume of service at times in the past. It was brought out by Mr. Kirkpatrick that about 55 or 60 per cent of the municipal plant's output is utilized in power service. The minimum price for energy is about 1.3 cents per kilowatt-hour; the maximum price for power is 4 cents, and the average price about 2.58 cents. The retail lighting rate is 6 cents per kilowatt-hour. If the power load of the plant were cut off, it would be necessary to charge 14 cents per kilowatt-hour for lighting service.

C. L. Newcomb, manager of the Deane works of the Worthington Pump & Machinery Company, pointed out that the Turners Falls company's proposal deserved serious consideration. In five years the present plant of the city will be hardly worth its scrap value. C. A. Crocker of the Crocker-McElwain Company pointed out that industrial New England is built up on water power and that in a manufacturing sense the whole United States is "out in competition with New England." The speaker maintained that the local generation of energy in the municipal plant can scarcely compete with a large modern station.

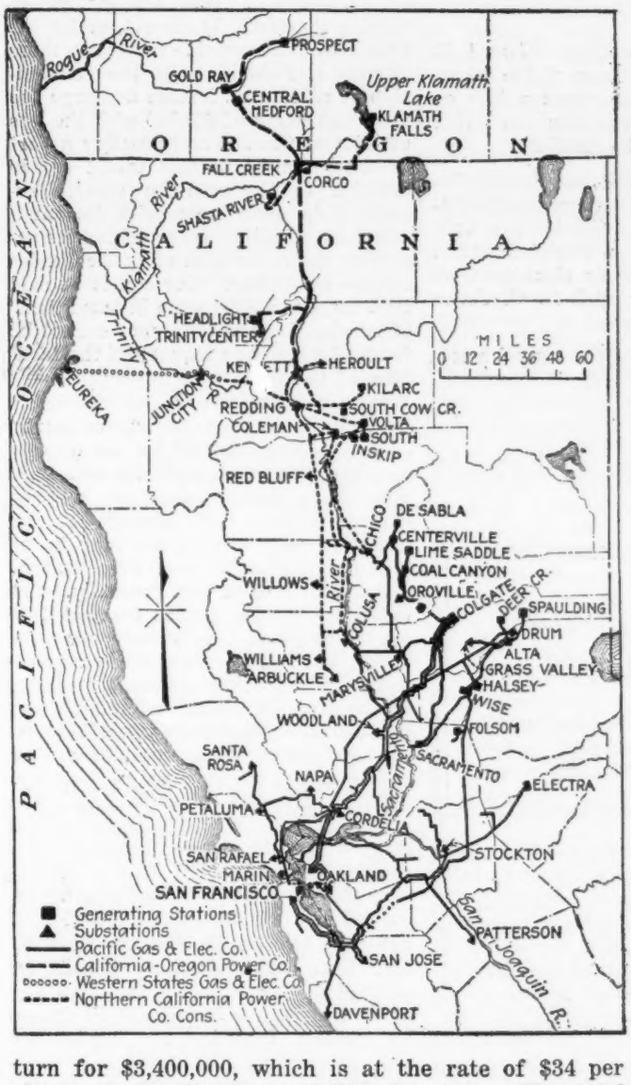
Other speakers emphasized the possibilities of transmission system interruptions and maintained that the city should develop its own plant regardless of outside offers to supply energy in bulk. It was finally voted to recommend to the Mayor and Board of Aldermen that a joint committee of the chamber and of the board select an independent engineer to report upon the proposition and advise the city as to the most desirable course to pursue.

PACIFIC GAS & ELECTRIC COMPANY GROWS IN SIZE

Purchases Northern California Power Company and Because of This Expansion Operates Largest Transmission System in the World

The board of directors of the Pacific Gas & Electric Company has ratified an agreement whereby that company takes over the ownership and the indebtedness of the Northern California Power Company properties. Final confirmation of the sale by stockholders of both companies is expected soon.

The purchasing company is to receive a deed to the properties, subject to the bonded indebtedness, in return for $3,400,000, which is at the rate of $34 per share of the Northern California stock. The total assets of the Northern California Power Company are rated at about $18,000,000.



This addition to the Pacific Gas & Electric Company's system will extend its transmission network to the Oregon line, links in the chain having been completed by the two companies during the past year.

The Pacific Gas & Electric Company serves an area of approximately 40,000 sq. miles, equivalent to a territory one-half the size of the New England States or three-fifths the size of the State of New York. Its circuits extend into thirty of the fifty-eight counties of the State of California. Electricity is supplied directly or indirectly through other companies to 214 cities and towns. The company operates at present thirteen hydroelectric stations and three steam stations. The generating capacity of the hydroelectric plants is over 160,000 hp., and the capacity of the steam plants is approximately 120,000 hp., or a total of approximately 283,000 hp. There are more than 6500 miles of high-tension and low-tension distribution circuits. The substations, of which there are 156, connect to the system with a total installed capacity of 321,000 kw. in transformers.

The hydroelectric developments of the Northern California Power Company are situated on Battle Creek and Old Cow Creek. The principal source of water supply is the western slope of Mount Lassen.

The company operates seven hydroelectric plants with a combined rating of 50,000 hp., waterworks at Redding and Willows, gas works at Redding, Red Bluff and Willows, and about forty-six substations. It supplies light to all important towns in Shasta, Tehama and Glenn Counties, Cal., and has a contract expiring December, 1925, to deliver 10,667 hp. to the Pacific Gas & Electric Company at Chico, Cal., where connection is made with that company's lines. Gas is manufactured and distributed in Redding, Red Bluff and Willows, and water is distributed for municipal and domestic uses in Redding and Willows. Franchises are without limitation in point of time in the cities; county franchises for the use of public highways for transmission lines expire from 1952 to 1956. There are more than 400 miles of 22,000-volt and 60,000-volt lines in the system.

SOUTHERN ILLINOIS COMPANY BOUGHT BY CHICAGO INTERESTS

Through Purchase of Common Stock, William A. Baehr and Associates Obtain Control of Property Supplying Fifty-five Communities

J. J. Frey of St. Louis and associates have sold the common stock of the Southern Illinois Light & Power Company to William A. Baehr, consulting engineer, Clement Studebaker, George Studebaker and associates of Chicago. This gives the Chicago interests control of the company without any change in its capitalization. The company has nine main and four reserve steam generating stations and 267 miles (430 km.) of high-tension transmission lines, from which it supplies fifty-five communities in fourteen counties in the State of Illinois. The maximum demand on the lines of the company is about 8000 kw. The principal towns on the system are Collinsville, Litchfield, Hillsboro, Mount Vernon, Duquoin, Chester, Nashville, Greenville, O'Fallon, Sparta and Eldorado.

William A. Baehr, consulting engineer of Chicago, supersedes J. J. Frey of St. Louis as president of the company. Mr. Frey retains an executive post with the company as vice-president and a member of the board of directors. Guy C. Lane of Hillsboro, Ill., is second vice-president. He was formerly the vice-president of the company. H. L. Hanley and Scott Brown, both of Chicago, are secretary and treasurer respectively. Mr. Baehr, the new president of the company, is interested in electric, gas and ice plants in Montana, Idaho, Oklahoma, Missouri, Ohio, Wisconsin and Illinois, and most of the companies are controlled by the North American Light & Power Company.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Toledo Joint Company Section Elects Officers.—M. H. Somerville and W. M. Berger were elected chairman and secretary respectively of this section on June 6.

A. I. & S. E. E., Birmingham Section.—This section of the Association of Iron and Steel Electrical Engineers is to hold an outing on July 4 at the hydroelectric plant of the Alabama Power Company, on the Coosa River.

A. A. E., Dallas Chapter Formed.—The Dallas Chapter of the American Association of Engineers was installed at a meeting on May 23, which resulted in the organization of a Dallas Engineers' Club to include all engineers of the city.

Engineers' Society of Milwaukee.—"The Motion Pictures' Secret Part in Winning the War" was the subject of G. G. Curtis, who spoke at the June 11 meeting. Films showing gasoline vapor, sound waves, electric energy and other unseen forces were displayed.

N. E. L. A., New England Section Convention.—The annual convention of the New England Section, National Electric Light Association, is to be held from Sept. 16 to Sept. 18 in the Hotel Griswold, New London, Conn. O. A. Bursiel, 1149 Tremont Street, Boston, is the section's secretary.

A. I. & S. E. E.—"Central-Station Power Rates" will be discussed by George M. Gadsby, vice-president of the West Penn Power Company, and E. C. Stone, system manager of the Duquesne Light Company, at the meeting of the Association of Iron and Steel Electrical Engineers to be held on June 21 at the Chatham Hotel, Pittsburgh, Pa.

Convention Held by Vancouver (B. C.) Contractor-Dealer Association.—At an electrical convention held by the association in Vancouver, B. C., on May 26 and 27, Samuel Adams Chase, special representative Westinghouse Electric & Manufacturing Company, spoke optimistically on the future of the electrical industry, and W. L. Goodwin gave a talk on "The Ills of the Industry."

Special Libraries Association Convention.—The Special Libraries Association, an organization to promote the interests of libraries devoted to particular professional and business subjects, will hold its tenth annual meeting at Asbury Park, N. J., June 24-26. Among the papers to be presented is one on "How the Special Library Can Help Build Industry," by F. M. Feiker, editorial director McGraw-Hill Company, publisher of the ELECTRICAL WORLD.

American Institute of Electrical Engineers

Fort Wayne Section.—C. I. Hall and O. B. Rinehart have been elected chairman and secretary-treasurer respectively of the Fort Wayne Section.

Pacific Coast Convention.—The Institute's Pacific Coast convention will be held in Los Angeles under the auspices of the Los Angeles Section from Sept. 18 to Sept. 20.

Atlanta Section.—Major Edward B. Craft, assistant engineer of the Western Electric Company, gave a talk on "Electrical Communication in War Times" at the May 30 meeting.

San Francisco Section.—"Recent Development in Long-Distance Radio-Telegraphy" was the subject of a talk by L. F. Fuller at a recent meeting. W. G. Vincent has been elected chairman of the section and A. G. Jones secretary.

Boston Section.—At the annual meeting of the section Irving E. Moultrop, Edison Electric Illuminating Company, Boston, was elected chairman for the ensuing year, and Ira Cushing, General Electric Company, Boston, was elected secretary-treasurer.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Facilities for Service.—The New York Public Service Commission, First District, in a decision affecting the Edison Electric Illuminating Company of Brooklyn, sustained a complaint alleging unlawful refusal to furnish electrical energy for power purposes. In part the decision, written by Commissioner Ordway, says: "In my opinion it was the intention of the Legislature to compel electrical corporations to supply adequate service to any and every consumer within 100 ft. of its consumers' wires. This section does not cover new extensions beyond the limits of existing service, but it does require that within the limits of existing domestic and commercial service the company shall not refuse adequate service to any consumer who desires it; otherwise the company might 'pick and choose' among its existing customers and give all of its energy to one on the ground that that one needed it all, and cut off entirely its other customers on the ground that its existing wires were only sufficient to serve the one. . . . As the commission is obliged, from the evidence comprising the record in this case, to find that the defendant is not rendering adequate service to a consumer it is already serving and does not have adequate facilities (*i. e.*, cables and wires running from its substation under these various streets) to render such service, and refuses to provide the same, the remedial power of the commission, which has been invoked by the complainant, must here be exercised. . . . The defendant's legal duty is to give reasonable, adequate and just service and to provide the necessary facilities and instrumentalities therefor. It cannot, under the definition of reasonable service to those already sustaining to it the relationship of customers, impose a charge (as the prepayment of $25,000 with the loss of interest thereon and possibly a part of the principal in fact would be) in addition to the rate for service demanded in accordance with its tariff schedules of all its other customers receiving the same kind of service under similar conditions. Nor can it be said that there is a difference in 'conditions' of service, for the difference cannot be founded upon the adequacy of the facilities of the defendant to serve one or more customers and the inadequacy of its facilities to serve another customer. . . . It is contended by the defendant that without a reasonable assurance that the additional facilities will be utilized by the complainant the expenditure to provide them may be an idle one, increasing carrying charges and expenses of service generally. The defendant should not be compelled to provide a plant unjustifiably excessive over the fairly anticipated requirements for rendering adequate service to the public. On the other hand, the defendant may not impose upon the complainant any other conditions or regulations for assuring a minimum quantity of consumption to justify the readiness to serve than it imposes upon other wholesale power consumers. The commission is impelled to the conclusion that the existing facilities of the defendant are inadequate for rendering adequate service to the complainant, and that the defendant should be ordered to provide such facilities and equipment and so increase and improve its present facilities and equipment, and particularly the feeders between its substation and the point in the street, opposite the premises of the complainant, from which the company's wires now enter the plant, as may be necessary to render adequate service to the complainant in the furnishing of electrical energy in the quantity and at the rate for which the complainant shall offer to enter into an agreement with the defendant in accordance with the forms of agreement provided by the rate schedules of the defendant on file with the commission, but without, however, the inclusion therein of 'rider No. 4.'"

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Stockton (Cal.) Has Most Electric Signs.—According to a survey of the electric sign situation in the United States recently completed by the Electrical Products Corporation, Stockton, Cal., has more electric signs per capita than any other city in the United States.

Electric Trucks Used by Leading Stores.—A. Jackson Marshall, secretary of the Electric Vehicle Section, National Electric Light Association, points out the fact that the electric commercial vehicle is employed extensively by many of the great department stores in this country and abroad. For example, Marshall Field & Company, Chicago, use 264 electric trucks, while Harrods, Ltd., London, England, employs 72. The "electric" has proved by long experience, Mr. Marshall adds, that it is the ideal truck for such frequent-stop transportation service.

Prize - Winning Central - Station Paper.—The papers committee of the Public Service Company of Northern Illinois Section of the National Electric Light Association has announced the winners of the 1919 papers contest. F. E. Andrews won first prize for a paper entitled "Our Job, Service"; J. S. Sproull won second prize for a paper entitled "The Soul of Utility," and the third prize was awarded to George E. Dunn for a paper entitled "If I Were —." The latter paper is particularly well adapted for distribution among employees of central-station companies.

Electrical Jobs for Men with Various Disabilities.—A returned soldier, whatever his disability and whether or not he has had previous experience, will, if he is at all interested in electricity, find some job that will be suitable for him, says the federal board in charge of this matter, so great is the present demand for electrical men. It is not surprising that courses in electricity, either in construction, maintenance or repair, are popular with disabled soldiers who go to the federal board for training. There are at present 178 men taking courses in the general subject of electricity. Thirteen are studying bench work and sixty-one are preparing to be electrical engineers. Disabled men can fill many positions in power plants, such as switchboard operators, substation operators, combustion experts and attendants of auxiliary machinery. Clerks whose duty it is to analyze and record the daily operating charts and compile them into cost records are being used more and more in electrical plants.

Louisville Company Provides Life Insurance for Employees.—Employees of the Louisville Gas & Electric Company received a surprise at a recent meeting of the employees' association in the form of an announcement that the company has provided life insurance amounting to $1,000 for each of its 500 employees.

New Cable Service to South America.—The Western Union Telegraph Company and the Western Telegraph Company of Great Britain have completed arrangements for direct cable service to Brazil and the eastern coast of South America. The new line will extend from Miami, Fla., via Barbados to Belem, Brazil, thence connecting with Rio Janeiro, Buenos Aires and the principal cities of the eastern seaboard. The project involves the laying of 3200 miles of cable, the work being equally divided between the two companies, and will probably be completed within six months.

Turning a River Into Power.—Lee, Higginson & Company, bankers of Boston and New York, in offering bonds of the Great Western Power Company, San Francisco, say: "We on the Atlantic Coast, living close to the best anthracite and bituminous coal in the world, hardly appreciate the value of water powers on the Pacific Coast, where there is no coal and where oil is becoming an increasingly costly fuel. The demand for power in California has doubled in the past eight years; it is expected to double again in the next six years. On the Feather River, the flow of which is always protected by a vast storage reservoir, the Great Western Power Company's principal plant, with 87,000 hp., is operated by half a dozen men. This means practical freedom from labor troubles."

Lynn Medical Director Indorses Anti-Tuberculosis Efforts.—The industrial importance of the war against tuberculosis was emphasized recently in a New England sanitarium campaign by Dr. F. E. Schubmehl, for the past six years medical director of the Lynn (Mass.) works of the General Electric Company. During this period from 14,000 to 16,000 persons were employed, and about every year 16,000 applicants for work received physical examinations. About 1 per cent were found to be tubercular to some degree. Some of the applicants were too ill to be employed, while others were hired and helped in working out their own cure. About forty employees have been sent to sanitariums at the company's expense. For some time the company has been keenly interested in combating this trouble, and it is considering plans for an institution for employees who are considered supicious cases. The importance of follow-up work and supervision among patients in whom the disease has been arrested or partially cured cannot be overemphasized, and the company is making every feasible effort to prevent the loss of employees through a relapse into unsatisfactory conditions of living and working.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contract of Public Service Corporation.—A contract of a public service corporation that conflicts with public duties imposed upon it by law is not within the protection of the constitutional provision inhibiting impairment of the obligations of contracts, according to the Supreme Court of Appeals of West Virginia (9 S.E. 208).

State Regulation of Interstate Commerce.—When, in the absence of federal regulations, state supervision of matters that incidentally affect interstate or foreign commerce is permissible the state authority is dominant, but upon the assertion of paramount federal authority state regulations in the premises are thereby excluded, according to the Supreme Court of Florida (81 S. 498).

Temporary Injunction.—According to the Supreme Court of Minnesota, a municipal corporation is entitled to a temporary injunction restraining an electric light company operating under a contract fixing rates from refusing to furnish service at the contract rates when it is protected by a bond securing it against loss in case it is finally decided that it should have been permitted to put into effect increased service rates (172 N. W. 217).

Reasonable Rates.—According to the Supreme Court of Minnesota, it will be presumed that rates specified in a contract between a municipal corporation and the grantee of a franchise to operate an electric light plant are reasonable, and the electric light company has the burden of proving that they are so low that a refusal to sanction an increase would result in depriving it of its property without due process of law, even though the ordinance granting the franchise and the contract itself do not unqualifiedly prohibit the company from increasing its rates (172 N. W. 217).

State Regulation in Local Matters.—The Supreme Court of Appeals of West Virginia has held that as to those forms of interstate commerce which are of national importance and require a general system and uniformity of regulation the federal power is exclusive, and the state may not act, even if Congress has not exerted its paramount legislative authority as to them. But where the subject is of local rather than national importance, admitting of diversity of treatment according to the special requirements of local conditions, the state may exercise its regulatory authority within reasonable limits till Congress does act (99 S.E. 207).

Men of the Industry

Changes in Personnel and Position—Biographical Notes

George B. Foster, who has been elected chairman of the Electric Vehicle Section of the National Electric Light Association, has been connected with the electrical industry for thirty-two years. In 1887 Mr. Foster entered the laboratory of the Chicago Edison Company. Between the time he left that company and 1908, when he joined the organization of the Commonwealth Edison Company, the successor of the Chicago Edison Company, he was engaged in several other branches of the industry. This experience included construction work with Leonard & Izard, supervision of electric lighting for the Chicago & Northwestern Railroad, direction of the arc lighting on grounds and buildings at the World's Columbian Exposition under Frederic Sargent and R. H. Pierce, Chicago district representation for the Wagner Electric & Manufacturing Company, the Bullock

GEORGE B. FOSTER

Electric Company and the Allis-Chalmers Company at Milwaukee, and manufacturers' agency at Chicago. When Mr. Foster opened an office to act as a manufacturers' agent he at the same time directed the operation of the Gunther Electric Company, which served a section of downtown Chicago. When the Gunther company was absorbed by the Commonwealth Edison Company, Mr. Foster became a member of the latter organization. He has now been eleven years in the employ of the Commonwealth Edison Company. His present position is that of assistant to Vice-president John F. Gilchrist, in charge of purchasing stores, transportation and statistical departments. During his work with the Commonwealth Edison Company his interest in the electric vehicle has done much to accelerate the growth of that business both locally and nationally. He has served three years as chairman of the Chicago Electric Vehicle Section of the National Electric Light Association and was for one year president of the Commonwealth Edison Section of the National Electric Light Association.

Philip H. Gadsden of Charleston, S. C., formerly president of the Charleston Consolidated Railway & Lighting Company and now vice-president of the United Gas Improvement Company of Philadelphia, has been elected a member of the executive committee of the Chamber of Commerce of the United States. Mr. Gadsden during the war was chairman of the American Electric Railway War Board and later chairman of its successor, the committee on national relations of the association, and also chairman of its committee on readjustment. His keen insight into public utility affairs and his unceasing efforts in presenting to government officials problems in financing and operating have won for him a prominent place as a public utility official.

H. H. Crowell, a vice-president of the Michigan Railway Company and the Consumers' Power Company, Jackson, Mich., who has represented the Commonwealth Power, Railway & Light Company interests for the last eight years, has been elected a vice-president of the Electric Bond & Share Company to fill the vacancy recently created by the death of George E. Claflin. Mr. Crowell has been identified with the electrical industry since 1889, when he entered the service of the Thomson-Houston Electric Company. Later he was New York State agent of the Thomson-Houston Motor Company and assistant New York State manager of the Thomson-Houston Electric Company until the organization of the General Electric Company, in 1893. He was manager of the Syracuse and Buffalo offices of the General Electric Company until 1906, when he became chief engineer of the Commission of Gas and Electricity of New York State, and later of the Public Service Commission, Second District. Since 1911 he has been with the Commonwealth Power Railway & Light Company properties in Michigan. He is a member of the National Committee on Public Utility Conditions, which has represented the public utilities in Washington during the war.

E. B. Katte, for many years chief engineer of electric traction of the New York Central Railroad, has been elected president of the New York Electrical Society. Mr. Katte is well known for the work he has done in connection with the electrification of the various lines of the New York Central in New York City and vicinity. This undertaking included the construction of two 20,000-kw. central power stations, nine substations, batteries and electric locomotives, car equipment and the third-rail and transmission systems required. He was born in St. Louis on Oct. 16, 1871, and in 1881 entered the Cutler School in New York City. Eight years later he went to Sibley College, Cornell University, and was graduated in 1893 with the degree of mechanical engineer. His thesis consisted of a commercial test of one of the first interurban electric railroads. After graduation Mr. Katte traveled through Switzerland and Germany, studying electro-hydraulic plants. He then returned to Cornell and took up special work in the design of vertical marine-type engines and in mechanical and electrical testing. Upon the completion of this course in 1894 he received the post-graduate degree of master of mechanical engineering. After a short term of service with Henry R. Worthington, he became assistant engineer in

E. B. KATTE

charge of the direction of the superstructure of the Park Avenue viaduct of the New York Central Railroad in New York City. In 1898 he was appointed mechanical engineer in the engineering department of the company. In addition to much general work for the company his duties as mechanical engineer embraced the design and installation of mechanical and electrical appliances for numerous coaling stations, water-supply stations, electric light and power plants for small passenger and freight stations, offices, yards, shops, transfer tables, cranes, drawbridges, etc. His appointment as chief engineer of electric traction dates from November, 1906. Mr. Katte served as vice-president of the Mechanical Society of Mechanical Engineers in 1913-1914. He is a fellow of the American Institute of Electrical Engineers and has served on the railroad committee of that body. He is a member of the American Electric Railway Association, the American Railway Engineering Association, the New York Railroad Club and the American Railway Association.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

WIRE AND CABLE SALES PICKING UP RAPIDLY

Indications Now Point to Full Capacity Production of Mills During the Coming Fall Months— Prices Advancing

Wire and cable manufacturers report a steady increase in orders booked. For a while incoming business was rather slow, particularly in the East. The Middle West and the South have been purchasing more steadily. Last week some very nice cable orders were placed in the East, and the manufacturers are of the opinion that better business is on the way.

Rubber-covered wire demand began to pick up perceptibly about five or six weeks ago and has gathered momentum ever since. Each time the price advanced the buying appeared to go ahead faster.

Steel-taped cable for street-lighting purposes is now moving faster. In fact, all kinds of cable are finding a better market to-day than they did a month ago.

Flexible armored conductor is in such demand that stocks are low almost everywhere. This condition has existed for some time.

With advancing copper prices and assurances of 10 to 15 per cent higher prices by the early fall the wire market should rapidly become better. In addition, construction work is getting larger every day.

There is every reason to believe that by September the copper wire mills of the country will again be running at full capacity.

RADIO VACUUM-TUBE LITIGATION IS SETTLED

Excellent Market for Thousands of Bulbs a Month in Prospect Now that the Three Rival Manufacturing Concerns Have Come to Arrangement

During the war litigation over rights for the manufacture and sale of vacuum-tube detectors for radio work was suspended by common consent, and tubes or "bulbs" for government use were made at various plants. As the situation stood at the close of hostilities an attractive market for bulbs was in prospect but patent rights prevented any one manufacturer from entering the field independently. The Marconi company held rights covering the use of a two-element bulb, Dr. De Forest's patents protected the use of the third element, and the Moorhead Laboratories in San Francisco had patented still other features also essential to the commercial production of the best tubes, among these being the use of a chemical process for exhausting air. During the war the Moorhead company had developed manufacturing facilities rapidly and bulbs were being turned out for the Allied governments at the rate of 30,000 per month.

Early in May representatives of the Marconi, De Forest and Moorhead companies held a conference in San Francisco and agreed that patent rights of all three should be extended to the Moorhead company, for which the latter should make payment to the other two on a royalty basis. In this connection it should be noted that this company is only permitted to make receiving and amplifying tubes, the Western Electric Company having the rights to manufacture the transmitting tubes. It was also agreed that the Marconi company would become the sole sales and distribution agent for the Moorhead output. The tube produced under this agreement is to be known as the Moorhead audion. Government contracts still operative will call for 15,000 bulbs per month, and within sixty days after the date of the contract the Marconi company, in the capacity of main distributing agent, is to receive bulbs at the rate of 50,000 per month.

THE ELECTRICAL BUSINESS OUTLOOK NOW MUCH BETTER

Indications During Past Month Are that Bottom in All Lines at Pittsfield General Electric Plant Has Been Reached

The Pittsfield (Mass.) Works of the General Electric Company, the largest industry in the city, are now employing between 5000 and 6000 hands, but not all on full time. Regarding present business conditions in the electrical industry and outlook, the general manager, C. C. Chesney, stated to a representative of the ELECTRICAL WORLD:

"Business as a whole in this plant has not shown any appreciable increase since the first of the year. Some lines have increased and others have decreased. During the past thirty days, however, there were indications that the bottom in all lines had been finally reached, and the outlook is now much better than it was three or four months ago. We are not contemplating entering upon any new manufacturing lines this year, but will confine our extensions to such lines as may be supplementary to the old ones, and in consequence we do not expect to build any additions to the plant this year as we have buildings sufficient now for a force of 8000 people. In the transformer department (transformers are our principal business) there has been increased activity during the past few weeks. The hot weather has also brought large sales of fan motors, and our sales in these this year will at least equal our last year's sales. By the beginning of next year I feel sure that the electrical industry in Pittsfield will be on its feet again."

LINE MATERIALS ARE TO GO TO HIGHER LEVELS

Advancing Prices of Copper and Lumber and Anticipated Strengthening of Steel Prices Make It Advisable to Place Orders Now

Prices of distribution and transmission-line material are lower at this writing than they probably will be at any time later in the year. Utilities that are contemplating the extension or rehabilitation of lines or the building of new ones would not be making a mistake if they placed their orders for the required material prior to July 1.

Wire is advancing steadily. At this writing weatherproof is on a 20-cent to 22-cent base and bare wire on a 19½-cent to 20-cent base. These prices are 2 cents to 3 cents higher than the prices of the spring.

Copper is being quoted at 17¾ cents for early delivery and more for August delivery. In fact, there is every indication now that copper will go as high as, if not higher than, 20 cents a pound during the early fall months.

Wire, in other words, can be expected during the next quarter to advance further from 10 to 15 per cent or even more.

Poles and cross-arms are due to advance from 10 to 15

is a potential market for a certain number of batteries a year, and after all it is the sale of battery refills that is the big market. Consequently users of flashlights must not be allowed to become dissatisfied.

Just as an example, flashlamps too frequently are carried about on the person or in a bag or trunk, or put away in such a way that contact is made and the battery discharged. When the owner goes to use the lamp he is disgusted to find it dead, and the case and lamp are relegated to the junk drawer, with much of the previous confidence in flashlights gone.

To prevent such occurrences and to increase the new uses of flashlights manufacturers feel it is necessary to impart some information to the many classes of dealers. This will probably be in the form of printed circulars inserted in packages of batteries as they are sent out. It would be practically impossible, it seems, to get in touch personally with sellers of lamps because of the diversity of retail distribution.

METAL MARKET SITUATION

Copper Market Rules Strong at 17.75 Cents—Tin Outlook Regarded as Satisfactory

Copper continues upward, although not in so big a step as last week. The general quotation for June and July is 17.75 cents and for August 18 cents. There is some hesitation about setting a price for September. Some smaller interests, however, are shading their prices about ⅛ cent. An authority in the copper world sets 20 cents as the price in the early fall.

The heavy buying has eased off a bit, but there has been no decline in price to tempt it back. Present requirements again seem to be met. Judging from recent past performances, buying will probably be light for a short time until manufacturers' stocks begin to drop a bit. Prices may recede a fraction, then, as restocking becomes necessary, buying will increase and prices jump up to a new level just above the present level.

Purchasing of copper is a little better than production at this time, and production is about the same as before the war and 60 to 80 per cent of November production. May sales approximate 200,000,000 lb., an extremely encouraging come-back.

The War Trade Board announces that applications will now be considered for licenses to import pig tin and tin alloys on condition that shipments will not be made from point of origin until June 30, and that these imports will not be permitted to enter till Aug. 1. Last week's sales of tin, it is stated, were nearly 500 tons, so that there are less than 600 tons of allocated tin left for disposal before restrictions on sales will be lifted. The zinc market is quiet.

NEW YORK METAL MARKET PRICES

	June 12	June 19
Copper:	£ s d	£ s d
London, standard spot	79 10 0	82 5 0
	Cents per Pound	Cents per Pound
Prime Lake	17.75	18.00
Electrolytic	17.62½	17.75
Casting	17.25	17.37½
Wire base	19.50 to 20.00	20.00 to 20.50
Lead, trust price	5.40	5.40
Antimony	8.37½	8.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	10.00	10.00
Spelter, spot	6.97½	6.90
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14.50 to 15.00	15.00 to 15.50
Brass, heavy	8.00 to 8.75	8.50 to 9.25
Brass, light	7.25 to 7.75	7.50 to 8.00
Lead, heavy	4.60 to 4.65	4.75 to 4.87½
Zinc, old scrap	4.50 to 4.75	4.75 to 5.00

THE WEEK
IN TRADE

AN INCREASING volume of business is reported from almost every section of the country. The Northwest, owing to the condition in the shipyards, is showing the least improvement.

For one reason and another wire sales are getting better rapidly. Appliance business shows no tendency to fall off except for fans. This was to be expected at the close of the hot spell.

Labor is somewhat unsteady this week, and unless the prices of foodstuffs show a more marked tendency downward higher wages may be demanded before the summer is over.

Few new credits are being placed at this time and collections keep up in good shape.

New construction is going ahead, and at the present rate the work under way in September should be enormous. Investment building is now coming in.

All prices, while steady, show a tendency upward rather than downward. Wire continues to advance.

NEW YORK

The month of June seems to be holding up well in sales of jobbers' materials. The quiet, steady growth in the business is satisfactory and shows the stability of the market. Prices show practically no fluctuations, and evidences of price cutting to stimulate trade are rare. Copper wire prices are tending upward, and so are lumber products. Otherwise general steadiness prevails.

Large contracting jobs are few and far between owing to lack of large residence, industrial, hotel and apartment-house building. But there is a large volume of small-residence building and small remodeling jobs, both residential and commercial. A large hotel is projected for Park Avenue, New York City, and another factory for Long Island City.

Collections are holding up in good shape and new extensions of credit are rarely sought.

INSULATORS.—Inquiries on high-tension insulators seem to be opening up in better volume, although little increase in ordering has been noticed. Manufacturers' agents report no change in price.

SCHEDULE MATERIAL.—Jobbers report orders running in better volume in this district. Open-wiring porcelain has little call in and around New York, but in regions a considerable distance from the large cities some jobbers have reported better sales. Porcelain prices are unchanged. Flexible non-metallic conduit is having little sale at present locally.

FLATIRONS.—Electric flatirons are enjoying just a fair summer sale. Where central-station campaigns are under way satisfactory results appear. One large department store in New York City is advertising a prominent make of electric iron complete for $2.50.

TRANSMISSION-LINE MATERIAL. — Orders for wooden poles are reported in better volume. Pick-ups from stocks at local points are satisfactory. Chestnut is having a better call. Buying of cross-arms continues in good shape. Stocks are reported in satisfactory condition to make quick shipments. The accompanying line material and hardware orders are growing larger in volume. With the announcement of an advance in lumber prices of 10 to 15 per cent to be effective July 1, prices on poles, cross-arms and wooden pins will be advanced, probably that amount, according to a prominent distributer. Another distributer it was learned on Tuesday, anticipated a sub-

per cent by the first of July, and in some instances cedar poles are advancing this week.

Pole-line hardware is undoubtedly as low as it is going. As soon as steel begins to stiffen in price, and that will probably happen in the next thirty to fifty days, hardware will go higher.

Insulators show no tendency downward. In fact, it would not be surprising if, in view of possible higher transportation and labor charges, the price of insulators advanced before the fall months.

Guy lines, anchors and transmission towers will probably be guided largly by the price of steel. Inasmuch as steel is expected in some quarters to go slightly higher in July or early August, there seems to be no good reason for believing that these products will go lower.

Transformers, it is learned on good authority, will go no lower this year. In fact, it is not improbable that costs may mount so rapidly that higher charge must be made.

Lightning arrester prices appear to be very steady. Cement for tower and pole ground work is also very steady.

CONTROL OF THE RESALE PRICE BY MANUFACTURER

Supreme Court Rules in Colgate Case that Seller Has Right to Choose Customer, Thereby Protecting Rights as Trade-Mark Owner

Of particular interest to electrical manufacturers of trade-mark goods is the recent decision of the United States Supreme Court upholding the decision of the federal district court in the action of the Federal Trade Commission against Colgate & Company, in which it was declared that the soap company in refusing to sell its product to certain objectionable distributers had not broken any of the provisions of the Sherman anti-trust law.

Action was brought by the commission against the soap company on the ground of unfair trade practices because the soap company refused to sell to certain distributers who would not resell the company's product at the price set by the company. The soap company took the stand that it had a right as a seller to choose its own customers and in so doing was merely protecting its own rights as an owner of a trade-marked article.

This decision, while at variance with some earlier decisions interpreting the anti-trust laws, will, it is understood, act as a most weighty precedent in future cases.

RELIABILITY IMPORTANT FACTOR IN BUILDING UP LAMP TRADE

Outline of Causes of Early Burn-outs Prepared by Leading Lamp Maker for Benefit of Factory Personnel

In the manufacture of incandescent lamps to meet modern specifications extraordinary care must be taken to avoid defective work and to maintain a high average of quality over a long period of production. It is remarkable how much abuse lamps will stand when properly made, and progressive manufacturers are constantly studying the processes of production to strengthen weak spots in their work and thus add to the good will which is so important a factor in their success. Responsibility for failures in service or for short life under normal operating conditions is easily brought home to the manufacturer, and the enormous number of units which he supplies to his trade in comparison with the number of units of large equipment marketed, combined with the delicate character of the operations and material involved in lamp making, justify extreme care in the factory.

An outline of some of the causes of early burn-outs recently prepared by a leading lamp maker for the benefit of his factory personnel suggests the importance set upon reliability as a factor in trade expansion. It would be difficult to cite another branch of the electrical industry where the quality of the product depends more upon the coöperation of the entire manufacturing organization. A few early burn-outs pull down the average life of the product; but, worse than this, they create an impression in the mind of the buyer out of all proportion to the loss of service resulting. Some of the practices avoided in high-quality production are as follows: Use of wrong size or cut of wire in mounting, error in marking stems, mixing lamps in process, mislabeling and oversight in inspection, improper amount of spraying in mounting, use of too small tubulating contractions, improper heating before exhausting bulbs, defective exhaust equipment, careless flashing and testing, poor sealing-in, careless tip-making and chipping of tips. and the premature removal of lamps from flashing machines. Adherence to good practice results in a product which will meet severe service tests, lighten the labors of the sales organization and establish a basis for trade expansion.

THE ITALIAN ELECTRICAL MARKET IS INCREASING

Local Production Not on Scale Large Enough to Take Care of Rapidly Growing Demand in the Kingdom

Owing to the lack of coal, Italy is preparing plans to utilize, as far as possible, the hydroelectric energy of the country. Several important plants are now in the course of construction, and it is estimated that in the near future these, together with the plants already in operation, will use up more than 1,000,000 hp. of the 3,000,000 hp. to 4,000,000 hp. remaining.

While there are in Italy some large manufacturers of electrical machinery, equipment and supplies—and a fair number of smaller manufacturers—still Italian production is not on a scale large enough to take care of the ever-increasing demand; furthermore, many types of electrical machinery are either not manufactured at all or their manufacture has just started. Before the war much of this equipment was made in Italy. Some of it came from Germany, and a small portion was purchased through the Italian agents of American companies.

American exporters, according to a statement put out by the Italian Discount & Trust Company, New York City, may be interested in knowing that the following products are not manufactured in Italy and that therefore a market in that country exists for them: Single-phase motors or three-phase motors with collectors, induction motors with auto-exciters, phase converters contained in a single machine, synchroscopes, phasometers and indicators. In the matter of electrical equipment for ship propulsion there exists an excellent market at this time, due to the activity of Italy's shipbuilding plants. Credit terms, quick shipments, and quality of the Italian standard are the main factors in this trade.

TO INCREASE POPULARITY OF ELECTRIC FLASHLAMP

Manufacturers Realize that More Work Must Be Done with the Dealer to Help Him to Sell This Product Better

Manufacturers of flashlight batteries are coming more and more to realize that the average person does not know fully the utility of the flashlight and that too many dealers are not able to educate the public in its use. Besides this, the confidence of the public must be obtained in a greater degree that prevails at present, and this confidence will be more largely enjoyed when the public knows for what purposes the flashlight can be used and how to use and not to use it.

The manufacturers propose to assist the dealers in every way possible to show the purchaser how to use the light and how it may be misused. For every flashlight sold there

stantial increase in Northern and Western cedar poles on Thursday or Friday of this week.

WIRELESS.—There is an increasing interest found in wireless work, particularly radio-telegraphy. Inquiries are coming for export.

WELDERS.—There has been a better buying movement in spot and butt welders in the last two weeks. The lighter volume of metal-working business in this district, however, does not bring as large a sale as will be found in the Middle West. The smaller sizes from 30-gage to $\frac{1}{8}$-in. sheets seem to have considerable call for spot work, while butt work runs in sizes up to $\frac{1}{2}$-in. and $\frac{3}{4}$-in. sheets.

FANS.—The cool weather of last week put a damper on fan sales, and up to early this week there has not been sufficient hot weather to cause another heavy buying spurt. Jobbers and dealers as a whole are in good shape to take care of another jump in sales, although some sizes, notably 16-in. oscillating direct-current fans, are low in stock with some concerns. Factories are replenishing jobbers' stocks in good shape. One large department store in New York City advertises certain 6-in. and 8-in. fans at about $1 less than regular price.

WIRE.—Rubber-covered base is quoted at 22 cents this week by seven manufacturers, at 20 cents by two, 25 cents by one, and one manufacturer quotes on cost.

CHICAGO

The popular expectation of lower commodity prices is at last being succeeded by the belief that a new level of value has been established, considerably higher than in pre-war times. Some commodities have declined toward this new level, and others have advanced by way of adjustment. Building materials are among those which show a tendency to advance. The building movement is gaining momentum after the prolonged wait on the part of builders for a lower range of costs which has failed to materialize. The construction of a two-million-dollar hotel near the Chicago Beach Hotel has been decided upon. This brings the hotels which have been projected during the past three or four months in this city up to a total of about $15,000,000.

Jobbers are experiencing an increased business due to the growing activity in buildings. The government business of last year in fans seems to be going into industries this year to increase the comfort of the workers. Sixteen-inch oscillators are being extensively used for this purpose. Utilities in Illinois, Indiana, Michigan and Iowa are building new lines.

WIRE.—The base on weatherproof wire is from 20 to 22 cents. Considerable quantities of No. 6 and No. 8 and some No. 4 are being sold for transmission-line work. The base on rubber-covered is from 19 cents to 23 cents. The demand is good, principally in house-wiring sizes. The price tendency is upward, but copper prices have changed so rapidly that the selling price depends largely on the price at which the jobber's stock was bought.

CONDUIT.—Conduit is in good demand with no change in price.

POLES.—The price of Northern white-cedar poles is expected to advance 10 to 15 per cent on July 1.

TIME SWITCHES.—One manufacturer's stock is almost depleted, and he is unable to get clock movements for ninety days.

CROSS-ARMS.—The increase in price of lumber is expected to cause an increase of 10 to 15 per cent in cross-arms by the first of next month.

CONTROLLERS.—One manufacturer reports a growing demand for equipment to control and regulate building equipment, such as fans, pumps, elevators, etc. Deliveries are being made in from two to three weeks.

FIXTURES.—There is a good demand for fixtures and reflectors for store illumination. Many of these are going into converted saloons.

REFRIGERATING MACHINES.—Manufacturers cannot supply the demand for electric domestic refrigerating machines.

CHURNS.—This is a new device on the market. One company is turning out seventy-five per week.

LINE HARDWARE.—The demand is strong and the price is firm.

FRACTIONAL-HORSEPOWER MOTORS.—The demand for repulsion motors is increasing more rapidly than the demand for slip-phase motors. Buyers are placing orders for their requirements up to a year ahead and having the motors shipped according to schedule in order to insure delivery. The business attracted a new manufacturer to the field.

FANS.—The demand for the smaller fans which was expected by many because of high prices has not materialized. There has been comparatively small call for sizes below 12 in. There has been an exceptionally large demand for 16-in. fans, especially oscillators. Ceiling fans are also selling well. One jobber reports having sold twice as many this year to date as were sold during the same period in 1918.

BOSTON

Trade is fairly good, considering the small amount of industrial construction under way for new developments. In some jobbing houses the sales are as good as or better than in May to the corresponding date, both in revenue and volume of commodities handled. New building work is gradually coming into its own. In Boston some large office building construction is well started, at Worcester comprehensive housing plans, starting with the immediate building of 100 three-family homes, are being tried out and the contractors are very busy in house-wiring work; in the Connecticut valley conditions continue excellent. Collections are good and deliveries satisfactory in most lines except armored flexible conduit. Wire stiffened about a cent in price last week, but other prices remain about the same. Seasonal appliances are moving well. There is a feeling that if the government establishes and maintains a constructive policy in dealing with business interests a long period of prosperity will be enjoyed. Labor exhibits much unrest, but the amount of non-employment is decreasing, especially in Connecticut, and on the whole New England is meeting the problems of readjustment well.

WIRE.—Weatherproof wire is steady at 22 cents base and bare wire has moved up a cent to 20 cents. A fair demand is noted, but in most cases it is not difficult to fill orders promptly. Flexible armored conductor is still far below normal in supply.

MOTORS.—The demand is confined chiefly to motors of 10 hp. and under. Manufacturers are stocking up so fast now that little trouble is experienced on deliveries. The total motor sales are naturally running considerably below those of last year, but in some cases half to two-thirds the turnover is being handled, which is good considering present conditions. Business is spotty and scattered very unevenly among motor sales organizations. Recently second-hand motor dealers have begun to buy new motors. So far the motor installations in former munitions plants have been closely held in place. After peace is signed some motors may be released, but no immediate prospect of price tobogganing can be seen.

FIXTURES.—The demand from residences and banking establishments is the feature of this business at this time. Some manufacturers are unable to fill orders at the desired rate, stocks having been left unreplenished during the war period. The larger houses distributing in New England are fairly well stocked. Prices are steady.

ELECTRIC TABLEWARE.—A short-lived gas company strike at Worcester last week threw the local appliance market into a ferment. Local dealers and jobbers were practically cleaned out of grills, hot plates and irons in a few hours. Had the strike lasted another day the demand upon Boston jobbers would have increased heavily; as it was, a lot of material was rushed to Worcester by twentieth-

century Paul Reveres, who made the most of their unusal opportunity.

STORAGE BATTERIES.—Automobile battery stocks are hard to maintain in face of the present demands. Trade is brisk in batteries for lighter service, such as telephone and signaling work. A big business in railroad-car lighting batteries is due soon, for little money has been spent in this way since the United States entered the war. Prices hold firm.

IRONS.—Sales are being well maintained, and the pushing of irons of lighter size for vacation use is coming to the front. In the Worcester gas strike last week many large electric irons were sold to accommodate tailors whose gas outfits were piped to temporarily dead mains.

VACUUM CLEANERS.—The market continues good, and the demand shows little sign of slacking off. Central Maine is absorbing this equipment at a striking rate this summer, but other parts of New England are buying their share too.

WASHERS.—A standing paragraph might be run as to the continuous heavy demand in all parts of New England. Deliveries are still pretty well kept up. Price seems to have little relation to the customer's desire to own apparatus of this class.

RADIO-TELEGRAPH APPARATUS.—Renewed interest in radio equipment is noted as a result of the relaxation of regulations relative to the erection of receiving stations.

ELECTRIC PASSENGER CARS.—The demand for some cars cannot be supplied at present. A steady growth of business is rewarding persistent workers in the sales field.

FANS.—A brisk demand continues for all standard types and sizes. Jobbers' stocks are being refilled.

ELECTRIC COAL LOADERS.—Stocks have been practically sold out in a representative manufacturing plant. Inquiries and orders are very brisk, with firm prices.

SEATTLE—PORTLAND

The volume of jobbers' business over the past two or three weeks shows little if any improvement. Sales are still light. Large purchasers of electrical equipment are persisting in hand-to-mouth buying. Prospective purchasers of electrical machinery which is to be used in electrifying plants and in making additions and betterments to existing plants are holding off until conditions settle down. Inquiries regarding equipment totaling in the aggregate thousands of dollars continue to come in, but orders are not following.

In Seattle last week, as far as can be learned, no large sales of consequence were made. However, the past month's volume was maintained. Seattle jobbers, as a whole, continue to predict heavy sales volume for the summer, stating indications were never brighter. Seattle retailers, on the other hand, report business during week showed a noticeable increase over last week, this being true particularly of dealers who are pushing sales of domestic appliances of all kinds.

The help problem in Seattle is hopeless. Unheard-of wages are offered, but still help cannot be obtained. With the exception of wire, which recently increased in price, prices remain comparatively firm. All stocks, generally speaking, are in good shape. Collections are good. No new credits are being placed.

The Portland territory reports an active trade in both jobbing and retail lines, with both jobbers and retailers looking forward to an unusually active summer season. Apparently, from reports, Portland men of the trade are not wasting time with gloomy predictions, nor are they waiting for a boom. The annual Rose Festival with its usual host of visitors from all over the Pacific slope, just concluded, did much to boost retail electrical sales during the past week. Jobbers report an exceptionally active market for washing machines and other household appliances, this being occasioned undoubtedly by the domestic employment situation, which is pressing, and to the unusually large number of June weddings. Collections are good and stocks in all lines are in good shape. There is a marked upward tendency in the price of wire, all kinds and sizes. Prices of other electrical appliances, including machinery and accessories, show but little variation. Manufacturers report that the sale of government motors at Vancouver, Wash., by the spruce production division recently has very materially affected the motor market in the Portland district. Many of these motors are new, having never been uncrated. Great activity continues in the construction of small business buildings, including public garages. Residence construction also continues unabated. Retail electrical trade has been exceptionally active during the past three weeks. May, 1919, exceeded the same month last year by a considerable margin, and June to date shows still further increases.

The Spokane district reports wholesale trade as very good and retail sales volumes as excellent. In the latter heaviest movement appears to be in washing machines and electric irons. Fan sales in Spokane increased noticeably last week. Collections are in good condition. There is considerable residence building, but big business construction is holding back. The labor situation in the Inland Empire is good and wages are from 65 to 70 per cent higher than before the war.

The return of the two-hundred-million-dollar French government order for steel ships to the Northwest is believed to be a certainty. The Foundation Company, operating plants in Portland and Tacoma, has an order from the French government for 104 steel ships. The beginning of construction awaits authorization from the Shipping Board, it is stated.

SAN FRANCISCO

Building permits for May, 1919, figured as follows: Los Angeles, $2,000,000; San Francisco, $1,250,000; Oakland, $550,000. This is a big increase in the aggregate over private building figures for several years past. Labor conditions are tightening again, with telephone operators' and wiremen's strikes scheduled. On the other hand, the telegraph strike seems fruitless, and the proposed Mooney sympathetic strike is condemned by conservative labor leaders as a Bolshevik movement.

The past week has witnessed a decisive drop in prices both for roughing-in and finishing material. Wire, however, remained steady. After several years special prices for some wiring staples in large quantities have been reinstated. It is too early, however, to state their effect.

CONDUIT AND FITTINGS.—Pacific Coast stocks of conduit are good and could be bettered were there the demand. Prices for all sizes and quantities have decreased 10 per cent. Special prices on boxes and covers in 1000-piece lots in full standard packages have been instituted, marking a 15 per cent decrease over former package prices, and lock nuts and bushings in 5000 lots of assorted packages made a 20 per cent drop. Flexible conduit has dropped 10 per cent, with a further decrease of 15 per cent in 5000-ft. lots. The demand on all these staples is far less than that of last year because of the absence of large special orders, but the orders are better distributed.

SCHEDULE MATERIAL.—Important changes have occurred in schedule price. Special quantity prices, such as those for push switches in 500 lots, standard sockets in 1000 lots, plug cut-outs and panel switches in 500 lots, are being quoted to stimulate business and decrease the present hand-to-mouth system of buying as well as to enable dealers to prepare for the expected fall business. All these prices give an extra profit of 15 per cent, but full standard packages must make up the quantities. Fuse plugs, too, carry an extra 10 per cent in 5000 assorted lots; in fact, prices and order quantities seem to be resuming their pre-war status.

RANGES.—Several San Francisco power companies are staging determined campaigns to increase their range load. A 3-cent rate in the Bay sector and a 4-cent sliding scale in the outer districts, coupled with credit and installation inducements, are proving popular factors. These efforts are not spectacular but steady and conservative and planned with the district dealers and contractors.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit.

Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

Armored Conductor, Flexible Steel

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

Twin-Conductor

	No. 14 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%
	No. 12 Solid
Less than coil	+10% to 20%
Coil to 1000 ft	List to 25%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	5%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$100.00
Coil to 1000 ft	82.50
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	5%

Attachment Plugs

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to list
1/5 to std. pkg	List to 20%
Std. pkg	25% to 36%

Batteries, Dry

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

Batteries, Dry—*Continued*

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.362	.372
Barrel lots	.332	.342

Conduit, Metallic Flexible

Size, In.	Ft. per Coil	List per 100 Ft.
3/8	250	$5.00
1/2	250	7.50
3/4	100	10.00
1	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single trip	$75.00	$63.75— 69.75
3/8-in. double strip	75.00— 82.50	72.00— 75.00
1/2-in. single strip	100.00	85.00— 93.00
1/2-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.25 to $63.75
3/8-in. double strip	78.25	71.25
1/2-in. single strip	100.00	75.00 to 85.00
1/2-in. double strip	105.00	93.00 to 95.00

Conduit, Non-Metallic Flexible

Size, In.	List per Foot	Size, In.	List per Foot
3/8	$0.05 1/2	1	$0.25
1/2	.06	1 1/4	.33
5/8	.09	1 1/2	.40
3/4	.12	1 3/4	.47
7/8	.15	2	.55
1	.18	2 1/2	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
3/8-in.—	$25.00	$20.75	$21.50
1/2-in.—	30.00	21.50	20.50

NET PER 1000 FT.—CHICAGO

	Less than 250 ft.	250 to 2500 ft.	2500 to 10,000 ft.
3/8-in.—	$33.00	$17.50	$16.25
1/2-in.—	36.00	19.00	17.25

Conduit, Couplings and Elbows, Rigid Iron

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08 1/2
3/8	.08 1/2
1/2	.08 1/2
3/4	.11 1/2
1	.17
1 1/4	.23
1 1/2	.27 1/2
2	.37 1/2
2 1/2	.58 1/2
3	.76 1/2

Conduit, Couplings and Elbows, Rigid Iron—*Continued*

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1 1/4	.17	.45
1 1/2	.21	.50
2	.28	1.10
2 1/2	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 12.1%	6% to 14.1%
2500 to 5000 lb.	9% to 15.1%	11% to 17.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3% to 6.1%	2% to 8.1%
2500 to 5000 lb.	+1% to 11.1%	4% to 13.1%

(For galvanized deduct six points from above discounts.)

Flatirons

NEW YORK

List price	$6.50 to $7.50
Discount	25%

CHICAGO

List price	$6.50 to $7.50
Discount	25% to 30%

Fuses, Inclosed

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

Fuse Plugs

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

Lamps, Mazda or Tungsten

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

Lamp Cord

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$26.47–$35.01
Coil to 1000 ft	23.82– 29.17

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00
Coil to 1000 ft	21.00

Lamp Guards, Wire

Standard packages from 50 to 150

NEW YORK

Net per 100	$29.70 to $33.00

CHICAGO

Net per 100	$29.70 to $33.00

Outlet Boxes

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%–38%	20%–33%
$10.00 to $50.00 list	36%–47%	31%–43%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	33%–40%	24%–32%
$10.00 to $50.00 list	45%–50%	32%–43%

Pipe Fittings

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

Porcelain Cleats—Unglazed

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.00 to $22.40
1/5 to std. pkg	12.00 to 15.35
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$17.85–$24.15
1/5 to std. pkg	14.70– 21.00
Standard pkg., 2200. List per 1000,	$20.00 to 21.00

Porcelain Knobs

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$13.60–$15.00	$22.00–$22.40
1/5 to std. pkg	10.50– 11.20	15.35– 18.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000
	5½ N.C.—Solid Nail-it—N.C.	
Less than 1/5 std. pkg	$13.60–$18.40	$27.20–$36.80
1/5 to std. pkg	11.20– 16.00	22.40– 32.00

Sockets and Receptacles

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20 to list
1/5 std. pkg	List to 10%

Switches, Knife

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-qmp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%
$10 to $25 list	+10%
$25 to $50 list	+5%
	Low Grade
Less than $10 list	+15%
$10 to $25 list	2%
$25 to $50 list	5%

Switches, Snap and Flush

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

Switches, Snap and Flush—*Continued*

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	23%

Switch Boxes, Sectional Conduit

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	18%–20%	List–18%
$2.00 to $10.00 list	28%–30%	5%–28%
$10.00 to $50.00 list	45%–50%	10%–47%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	30% to 33%	24% to 25%
$2.00 to $10.00 list	30% to 33%	24% to 25%
$10.00 to $50.00 list	30% to 45%	25% to 36%

Toasters, Upright

NEW YORK

List price	$6.00 to $7.00
Discount	25%

CHICAGO

List price	$7.00
Discount	25% to 30%

Wire, Annunciator

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.42
No. 18, full spools	.35– .40

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.46 to $0.56
No. 18, full spools	.41 to .51

Wire, Rubber-Covered, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$14.15–$14.50	$10.50–$12.65	$10.50–$10.60
12	18.90	18.90	14.18
10	25.50	25.50	17.00
8	34.94	29.10	23.28
6	55.38	46.15	36.92

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.50	$10.00–$11.00	$9.50–$10.00
12	22.05	22.05	18.90
10	29.68	29.08	25.44
8	40.39	34.62	24.62
6	63.84	54.72	54.72

Wire, Weatherproof

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Ins.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$27.00–$29.25
25 to 50 lb	27.00– 25.25
50 to 100 lb	26.00– 23.25

CHICAGO

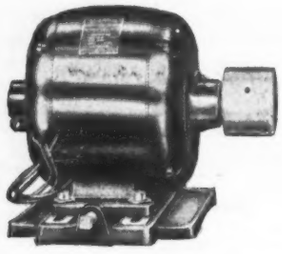
	Per 100 Lb. Net
Less than 25 lb	$25.75 to $26.50
25 to 50 lb	25.75 to 26.50
50 to 100 lb	25.75 to 26.50

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Interchangeable-Type Electric Motors

Physically interchangeable motors—that is, motors having their important dimensions the same—are especially advantageous to the manufacturer of

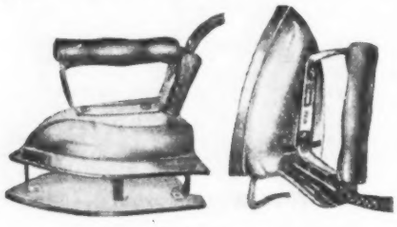


INTERCHANGEABLE-TYPE 2-HP. THREE-PHASE MOTOR

motor-equipped machines who may furnish equipment for use on various kinds of circuits. The Emerson Electric Manufacturing Company, 2024 Washington Avenue, St. Louis, Mo., is marketing a line of motors, including stock types of single-phase, multiphase and direct-current motors of corresponding rating operating at identical speeds. They range in size from 1/30 hp. to 2 hp.

Flatiron with a Cement-Embedded Heating Element

Among the features of the "Guaranteed" electric iron pointed out by Manning, Bowman & Company, Meriden, Conn., who now manufacture it, are the blue steel sole plate highly finished in nickel plate to make it glide smoothly, the cord protected against wear by a coiled guard, the contact plug held securely by a locking device



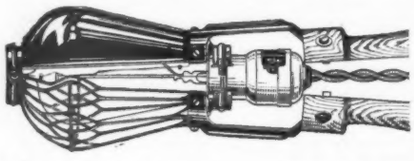
FURNISHED WITH EITHER REVERSIBLE OR HEEL STAND

which insures perfect electrical connection, and the solid-steel heating core which prevents cooling in heavy work.

The heating element used in the iron is made of Nichrome wire embedded in cement, making the unit practically indestructible. To prevent heat from traveling up the upper part of the iron and to drive it downward, where it is needed, an asbestos pad is inserted between the bottom of the pressure plate and the top of the heating unit. There are also asbestos washers between the bottom of the handle strap and the top cover stamping to prevent heat conduction into the handle. The wooden handle of the iron is strongly constructed, having a bolt through its entire length. Two types of stands may be had—a reversible style or a heel stand. Each iron is furnished with 6½ ft. (2 m.) of cord and lamp socket connections.

Split-Handle Portable Reflector Lamp Guard

With the "Flexco" split-handle portable reflector lamp guard, which is now marketed by the Flexible Steel Lacing Company of Chicago, rays of light can be reflected away from the eyes of the user and concentrated on the work. In



OPENS IN HALF TO RECEIVE EXTENSION OR DROP CORD, SOCKET AND BULB

shops, garages, plants and in other places where ordinary fixture lighting is insufficient, such as engine pits and under machines, this reflector lamp guard may be used safely and conveniently.

Unlike the ordinary type of guard this split-handle type does not have to be wired. It opens in half to receive the lamp bulb, socket and cord without rewiring. The guard proper, made of expanded steel, coated with tin, clamps over the bulb, while the cord runs through a groove in the split handle, the latter being adjustable by means of screws.

Aluminum Vacuum Cleaner with Adjustable Nozzle

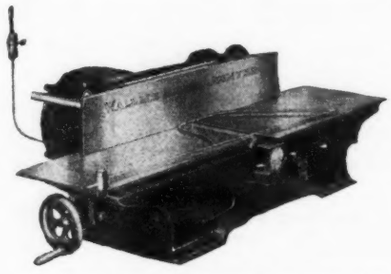
An electrically operated vacuum cleaner having a cast-aluminum body and a high-speed General Electric air-cooled universal-type motor has been announced by the Hotpoint division of the Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, and is known as "Hotpoint" model V2.

A stationary-type, adjustable-bristle brush is employed and is said to brush the dirt out of the carpets without injuring them. A powerful suction is created by the motor, which has a removable dome. The 13½-in. (34-cm.) nozzle of the cleaner is adjustable, the height being changed for various lengths of nap by a conveniently placed thumb screw. The dust bag is lined and, while it has tight connections, is easily removed for emptying. A light hard-wood handle is furnished and is fitted with a pistol-grip control. When not in use it remains in the vertical position. Rubber-tired wheels insure smooth and quiet running. Eight easily connected attachments for cleaning draperies, furniture and so forth are supplied with the machine, which has standard separable plug motor connections and 20 ft. (6 m.) of cord.

Electrically Operated Portable Wood Jointer

In order to save the time usually spent by workmen in woodworking shops walking back and forth from their benches carrying small work to the large stationary jointer the J. D. Wallace Company, Station C, Chicago, has developed a portable bench-type electrically operated 6-in. (15-cm.) jointer. By its use the workman is enabled to do the bulk of his small planing without moving from his bench, thus saving considerable time and releasing the large stationary jointer for major operations.

An especially interesting feature of the machine is the fence which is mounted on the motor and slides backward or forward on rods, rendering



SIDE VIEW OF ADJUSTABLE FRONT AND REAR TABLES AND SAFETY GUARDS

it quickly and accurately adjustable. Another point of interest is the manner in which the motor, which is operated from an ordinary light socket, is applied. The cutter head can be easily taken out and other heads inserted in only a few seconds. Tables are ar-

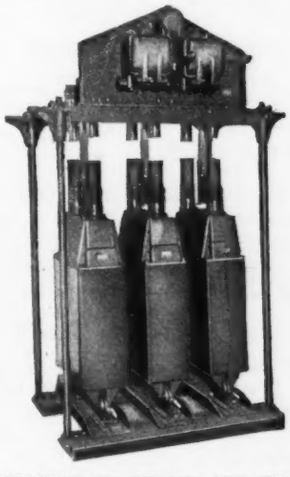
ranged to slide backward to permit the use of these special heads, or forward so as to work with the narrowest possible throat opening, a feature that will prove especially desirable when the machine is doing small or very close work.

Removable-Unit Oil Switches and Circuit Breakers

Switching equipment capable not only of interrupting large quantities of energy but also able to withstand the thermal effect and mechanical strains incident to such current rushes is necessitated by the increase in capacity of generating and transforming apparatus, the interconnection of feeders and the interlinking of distribution systems. The Condit Electrical Manufacturing Company of South Boston, Mass., has lately brought out type F-6 oil switches and circuit breakers, three-pole type, cell mounting, in 500-amp. and 800-amp. capacities, where the pressure is not in excess of 15,000 volts. They may be arranged for either hand remote control or electrical operation.

The removable-unit constructional feature of these oil circuit breakers renders possible quick replacement, repair or inspection. The operating mechanism is entirely inclosed in the expansion chamber, which is fastened to a steel tank supported on a three-point truck to facilitate handling. The electrically operated mechanism, of simple and compact design, is mounted above the switch units. The conductors may be brought to the circuit breaker through the top or the rear of the cell.

Other features of these oil switches and circuit breakers are the laminated brush, reversible and easily replaceable arcing tips, self-aligning, sure-seating action between the movable contact members and the stationary contact



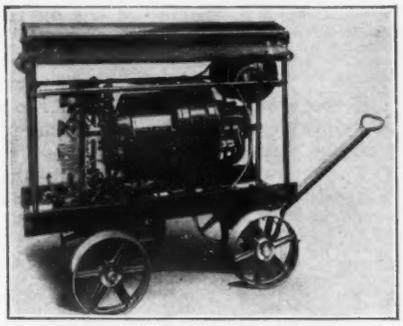
EASY INSPECTION, REPAIR AND REPLACEMENT MADE POSSIBLE

members, the rugged tank-per-pole construction, high head of oil over break, arge expansion chamber, and the strong spring action of the brushes, which facilitates rapid acceleration of the movable ccntacts upon the initial opening of the circuit.

Arc Welders for Portable and Stationary Use

A line of electric arc-welding machinery has been developed by the U. S. Light & Heat Corporation of Niagara Falls, N. Y. For shops where it is practicable to bring the parts to be welded near to the welding apparatus a stationary type is provided; otherwise a light-weight portable truck-mounted machine can be used.

With rated capacity of 4 kw. these arc welders give 200 amp. direct current or less, with an arc voltage of 17 volts to 22 volts and open-circuit voltage of 35 volts to 65 volts. They are made in the form of a converter for use on 100-volt to 125-volt circuits only and in the form of a motor-generator for all other alternating-current and direct-current circuits. Weighing 665 lb. (301 kg.) the converter delivers



TRUCK AND EQUIPMENT CAN BE EASILY PULLED AROUND THE SHOP

current at the arc through the arc-stabilizing reactor with an efficiency of 65 to 70 per cent, it is said.

The motor-generator type consists of a 7½-hp. alternating-current or direct-current motor on the same shaft with a 4-kw. "USL" welding generator. Inherently regulated, compound-wound, self-excited and with drooping voltage characteristic, it is claimed that the generator, as well as the converter, produces an arc peculiarly suited to arc welding.

Controller for Storage-Battery Industrial Trucks

Designed for use on storage-battery industrial trucks and tractors, the "Ogden" type NS automatic controller with self-contained safety switch, made by the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, is said to be particularly suited for this low-voltage, heavy-current work because of its indestructible metallic drum, which provides an excess of current-carrying capacity. The controller drum moves from speed to speed in a quick and positive manner, assuming a definite position each time.

The heavy, renewable copper segments and oversize fingers reduce burning to a minimum, and the voltage drop is practically nil, permitting the use of a minimum of battery cells. As the segments are mounted on a metal base, they may be replaced indefinitely without causing any injury to the drum proper.

The quick-break safety switch is self-contained within the controller housing and mechanically connected to the

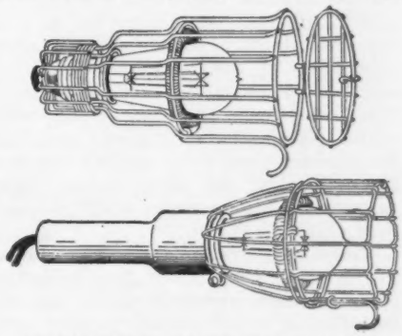
PHANTOM VIEW, SHOWING QUICK-MOVEMENT, POSITIVE-STOP MECHANISM

motor brake so that when the brake is applied the switch opens instantly, disconnecting the motor. Being mechanically interlocked with the main drum, the switch cannot again be reclosed and the truck started until the controller handle has been brought to neutral position.

Portable Lamp Guards with Safety Cushion Ring

The portable hand-lamp guards manufactured by Frank W. Morse, 289 Congress Street, Boston, have been improved by the addition of a cushion ring which keeps the lamp bulb in the center and prevents it from touching the outside guard. The bulb is therefore prevented from breaking at the neck should the guard be dropped on the floor or struck.

These guards, which have an electroplated finish and are thus not likely to rust, are made in a number of styles and sizes. The "Heavy" guard can be placed on end and has a hook which allows it to be hung perpendicularly. The

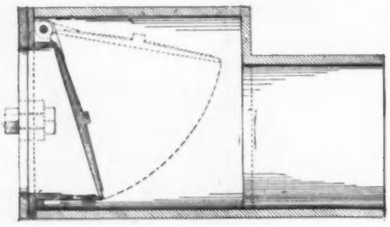


NO HANDLE WITH TOP STYLE; LOWER GUARD CAN BE STOOD ON END

"Ryerson," in addition to these features, protects a weatherproof socket as well as the bulb and requires no wooden handle. The "Handy" is stronger than the first guard and the "Eureka" has an extra strengthening ring and an opening for a key socket.

Back-Pressure Valve for Manholes

For preventing sewer water from backing up into manholes and flooding the underground conduit system the "Maco" back-pressure valve is being



STOPS SEWER WATER FROM BACKING INTO MANHOLES AND FLOODING CONDUIT

marketed by W. F. Cummings, Inc., 330 South Paulina Street, Chicago. Manholes are kept free from water and dirt to the height at which the valve is placed in the wall. The depth of the sewer regulates the height in the wall where the valve must be installed. It is, of course, placed as near the floor as possible. The valve is simply constructed, and should the sewer tile become clogged the valve grate may be readily removed.

Circuit Breaker with 635,000 Kva. Rupturing Capacity

One feature of the 15,000-volt type CO-2 oil circuit breakers which the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has recently developed is that they have a rupturing capacity of 635,000 arc kva. at 12,000 volts and are capable of opening such a short circuit twice in succession at least two minutes apart and still be immediately reoperative for non-automatic service without any necessity for immediate inspection or cleaning of contact parts or renewal of oil.

Furthermore, the manufacturer declares that it is possible to perform this operation without throwing an excessive quantity of oil or damaging any part of the breaker beyond the burning or pitting of arcing contacts. The breakers are designed to withstand the mechanical stresses that may be imposed upon them during the first few cycles of the short circuit when unsymmetrical currents of high value may exist.

These breakers are for indoor mounting in brick, concrete or steel structure compartments apart from the switchboard—that is, for remote control—and are adapted for electrical operation only. The two outstanding features of the "CO-2" breakers are their compactness and ease of installation. No intermediate structural walls are required for the individual poles, all of them being supported from a common steel top. The breaker is supported in the structure compartment by means of anchor plates set in and projecting from the cell walls. The steel top of the circuit breaker rests on these anchor plates and bolts hold it securely in place.

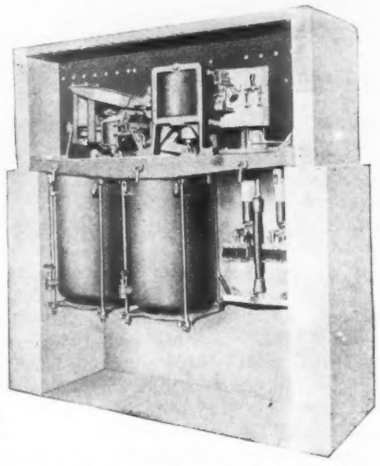
The breaker tanks are round and seamless, being die-pressed from heavy sheet steel. To avoid arcing between contacts and tanks two sets of removable micarta insulating linings are used in each tank which are 20 in. (50 cm.) in diameter. The tanks are dead and may be grounded.

Among other features of this breaker are the form of tank, use of steel supporting flanges, steel tie rods (four per pole) and cradles, steel tops, large volume and head of oil, liberal air chamber over oil, together with the high-speed arcing tips and rapid acceleration of moving contacts when opening.

The tanks are deep, providing ample space above the oil level as an expansion chamber for the arc gases and also to reduce slopping of the oil from internal disturbances.

The gases are vented through a specially designed check valve providing free venting of gases under ordinary pressure but at the same time preventing passage of oil.

The operating mechanism is mounted above the steel bedplate from the under



BREAKER IS SUPPORTED IN STRUCTURE COMPARTMENT BY MEANS OF ANCHOR PLATES

side of which the tanks are supported. The lift rods attached to the moving contacts of each pole unit are connected to a common operating mechanism actuated through a toggle lever by the solenoid operating mechanism.

A powerful accelerating spring is provided as an integral part of the operating mechanism to assist gravity in forcing the breaker to the open position. An air-cylinder dash pot in conjunction with the leather bumpers on each pole brings the moving parts to rest without shock.

The standard breakers are supplied with vertically arranged leads brought out at the rear of the cell. These leads are insulated for full line potential. In the vertical arrangement the leads are brought out one above the other on the center line of each cell space.

Electric Fireplace Log

An electric "log" for fireplace use has been recently developed by Strait & Richards, Fabyan Place and Selvage Street, Newark, N. J. The log illustrated is a 20-in. (51-cm.) style, which can

HEATING ELEMENTS EASILY REPLACED

be wired for operation on any current above 2000 watts. It is regularly equipped for 110 volts and is supplied fully wired and with a stand, but without a switch, since the varying conditions of installations make a standard impracticable.

The heating elements of this contrivance are arranged in such a manner that they can easily be replaced. The life of each element, the makers say, is upward of 2000 hours, continuous running.

NOTES ON RECENT APPLIANCES

Farm-Lighting Plant

The Gray Motor Company of Detroit, Mich., is marketing a farm-lighting plant with a 1-kw. capacity.

Bell-Ringing Transformers

Single-circuit and three-circuit type bell-ringing transformers have been developed by the Empire Transformer Company, Chicago.

Hospital Lighting Fixtures

Inclosed indirect lighting fixtures for installation in hospitals are now made by the M. J. Grady Fixture Manufacturing Company, Minneapolis, Minn.

Electric Dryer for Shoe Soles

For use in shoe factories to dry shoe soles the Millner Electric & Manufacturing Company, 1706 North Twelfth Street, St. Louis, Mo., has developed an electrically heated dryer.

Heavy-Duty Circuit Breaker

A circuit breaker of 3000-amp. and 4000-amp. capacity, known as "type LRL," for heavy-duty work such as is met with in steel mills and street-railway service, has been recently put on the market by the Automatic Reclosing Circuit Breaker Company of Columbus, Ohio.

Trade Notes

Foreign Trade Opportunities

The Netherlands Legation at Washington has just opened a commercial department for the purpose of fostering trade between the United States and Holland and is in a position to give commercial information about trade between the two countries to American merchants.

Harrods, Ltd., London, England, which is one of the largest department stores in the British Empire, is in the market for electrical goods of American manufacture, both for London and for Belgian wholesale department. Representatives will be seen by appointment at Harrods, 225 Fifth Avenue, New York City.

The Aktiebolaget Elektrisk Materiel, Radmansgatan 73, Stockholm, Sweden, wholesale dealer in electrical machinery and materials, desires to get in touch with American manufacturers who want an agent in Scandinavia, Finland and Russia. Information may be obtained from the National Export Advertising Service, New York City.

COMMERCE WITH SPAIN.—Imports into Spain of copper wire in 1916 were $79,200 from the United States, $3,957 from France, and $20,822 from Great Britain. Of electric motors and generators, imports in 1916 were $579,179 from the States, $17 from Argentina, $170,694 from France, $342,421 from Great Britain, and $34,622 from the Netherlands. In 1916 and 1917 imports of copper wire were respectively $825,104 and $970,720; electric lamps and bulbs, $403,479 and $307,254; electric insulated wire, $43,815 and $57,342; electric motors and generators, $1,652,769 and $1,452,565; telegraph and telephone materials, $843,842 and $602,313. Many other imports also decreased during 1917.

ELECTRICAL STOCKS IN SOUTH AFRICA LOW.—Reports from English correspondents in South Africa are to the effect that stocks of electrical supplies are very low, except lamps, which seem to be in exceedingly plentiful supply. Conduit is reported as especially scarce and expensive. Local consulting engineers, it is reported, have standards for motors, transformers and general mining electrical supplies, and on these standards all mining supplies will be ordered. Good prospects for equipment for electrical business for industrial plants are reported, and better orders are also expected from the smaller lighting plants. Japan appears to be making a formidable attempt to corral this market and has placed large stocks, particularly wiring.

BUILDING PLAN FOR EMPLOYEES OF AMERICAN BLOWER COMPANY.—To aid its employees in acquiring their own homes the American Blower Company, Detroit, Mich., has organized an advisory and financial service in its welfare department. Officials of this concern occasionally talk to employees on the economy and value of acquiring homes, giving practical suggestions as to how to go about purchasing a lot and building a house. This is an outgrowth of the savings and investment movement resulting from war finance experiences, and thrift and war savings stamp investments are increasing generally. It is laid down as a general proposition that any married employee earning $25 a week is in a position to invest $3,300 in a cottage and lot, and that this will be cheaper than the average Detroit rentals, as well as give better living quarters and independence. Speaking recently to employees of that plant, the secretary of the company explained that if an employee owns an eight-hundred-dollar lot or has that sum in savings with which to buy one, it is possible to build a cottage costing $2,500 on it. The first step is to select the lot, and as location is important in determining mortgage value, the company advises that employees confer with the secretary of the Society for Savings, a Detroit thrift institution. Through experience in real estate this official is able to suggest locations and very often save money on the price. The next step is securing a loan for building. The Society for Savings will lend 60 per cent of the total value of house and lot. The lot being $800 and the house $2,500, this yields $1,980 on a mortgage. Before building can start it is necessary to borrow $520 additional, and this is loaned by the American Blower Company. One mortgage covers the whole transaction, as the Society for Savings issues the mortgage for $2,500 and the company pays the additional $525 into that institution. Care is taken to make clear to employees that this is not benevolence on the company's part, because the Society for Savings issues certificates of deposit to the company for its money and these certificates pay 5 per cent interest.

PROSPEROUS ELECTRICAL YEAR IN SWEDEN.—Reports from larger electrical manufacturers of Sweden indicate that 1918 was a very prosperous year in that country. Sales of transformers and transmission-line material were especially good. The three largest electrical manufacturers increased their capital stock by 50 per cent, and many additions were made to manufacturing facilities. Developments are now under way to increase the production of transformers, motors and generators and other electrical products. Electrification of the rural districts is occupying the attention of the trade at the present time, and according to authentic reports from Sweden it seems probable that this development will be undertaken quite extensively, with the backing of the government, in the near future.

KRANTZ COMPANY GROWING.—The Krantz Manufacturing Company, Inc., of Brooklyn, is now a subsidiary of the Westinghouse Electric & Manufacturing Company and in the past year has been remade and enlarged considerably. For about twenty years the Krantz company has been actively engaged in the manufacture of switches, switchboards and panelboards. In the last few years a complete line of safety switches, safety switchboards and safety panelboards has been developed. On account of the small representation, however, the greater part of the output was sold for local installations in two or three central localities, but with the sales forces of the Westinghouse Electric & Manufacturing Company, the Westinghouse Export Company and the Canadian Krantz Electric & Manufacturing Company it is expected that the output of the Krantz factory will be made more widely known. During the past year several very important contracts have been completed, headed by the Pennsylvania Hotel, which covered the switchboards and panelboards for the entire building. Contracts were secured also for installations at the new army base at Brooklyn, N. Y., and for the Elks' Home in New Orleans.

THE RISDON TOOL & MACHINE COMPANY, Naugatuck, Conn., reports the establishment of a number of selling agencies throughout the county and in several of the foreign countries. The company has recently added some new socket shells to its line.

THE WHITE LILY MANUFACTURING COMPANY of Davenport, Iowa, manufacturer of electric washing machines, it is reported, will erect a 20-ft. by 225-ft. addition to its factory, a 25-ft. by 30-ft. warehouse and seven auxiliary buildings, each 25 ft. by 30 ft. The contract for the improvements planned has been let.

THE ROLLER-SMITH COMPANY, New York City, announces that it is now represented in St. Paul, Minn., by A. H. Savage, Pioneer Building. Mr. Savage will handle the company's various lines of instruments, meters and circuit breakers in Minnesota and North Dakota and part of Wisconsin and South Dakota. Mr. Savage prior to 1914 represented the Fort Wayne Electric Works in St. Paul, and in 1914 he became a representative of the Wagner Electric Manufacturing Company of St. Louis, he being now in charge of the St. Paul office of that concern. At the present time Mr. Savage is treasurer of the Dakota Light & Power Company of Flandreau, S. D., and is also president of the South Dakota Power Association. He has been in the Northwest for over eighteen years.

THE PLATT IRON WORKS, Dayton, Ohio, which last year was engaged 100 per cent in direct war work, reports that a great maority of this work has been discontinued and that the company is now returning to its regular line of products of pumps, water heaters and oil-mill machinery. A number of new agents in the field have been appointed, as follows: The Charles F. Ames Company, 90 West Street, New York City, covering the entire territory of New York State and partof New Jersey and Connecticut; the W. P. MacKenzie Company, Pennsylvania Building, Philadelphia, covering the Philadelphia territory, and the Texas Manufacturing Company of Fort Worth, Tex., covering that part of the country. The factory space of the company was enlarged during the war, but at the present time the new building is not being used for its regular products.

THE DETROIT INSULATED WIRE COMPANY announces that R. S. Wakefield has recently been appointed representative for Texas with offices at 13,123 Great Southern Life Building, Dallas.

THE TOLEDO SCREW PRODUCTS COMPANY, Toledo, Ohio, will shortly begin the manufacture of vacuum cleaners. These will be put on the market by the Air-Way Company, 1229 Ohio Building, T. H. Tracy, president.

THE CROUSE-HINDS COMPANY of Syracuse, N. Y., announces that P. A. Fuss has joined its staff in an advertising capacity after a number of years of service for the Thomas Edison Company and the T. G. Plant Company.

F. W. MARSHNER has been appointed as manager of the Detroit branch of the New Departure Manufacturing Company, succeeding the late Samuel B. Dusinberre. Mr. Marshner has been with the company at its Detroit office for something like seven years, having been an engineer salesman.

THE AMERICAN APPLIANCE COMPANY, manufacturer and distributer of incandescent lamps and specialties, states that it has recently opened an additional branch in Dallas, Tex., at 1812-1814 Live Oak Street. This makes seven branches, at every one of which is a warehouse and complete stock of all different kinds of incandescent lamps.

W. H. HUSTON, production manager of the Robbins & Myers Company, Springfield, Ohio, is to take charge of production, purchasing and material at the plant of the Dayton Fan & Motor Company, effective June 1. W. A. Lubbers will succeed Mr. Huston as production manager, and William Winters will succeed Mr. Lubbers as assistant production manager.

THE ECLIPSE FOLDING MACHINE COMPANY, Sidney, Ohio, manufacturer of portable electric cleaners, has within the past two years tripled the factory space devoted to the manufacture of cleaners. The distribution of these products is now largely through territorial agencies or distributers. Sales for 1919 are approximately 300 per cent greater than any former year, while the factory is working about thirty days behind orders. E. C. Brown is now sales manager of the company.

THE BROOKINGS COMPANY, Cleveland, reports that during the past year it has built up a large export business in lighting fixtures. I. I. Hance, manager of the commercial lighting department of the company, states that agencies have been established in China, Japan and Australia. The company has shipped many thousands of dollars' worth of fixtures to these countries during the past six months and has in its factory nearing completion a large order destined for Shanghai, China.

C. J. COOPER, JR., who has recently resigned as general manager of the Mineral Point Public Service Company, has joined the forces of J. H. Jones, Northwestern manager of the Hoover Suction Sweeper Company, where he will be engaged in promotion work. Mr. Cooper, before he became general manager of the Mineral Point property, was superintendent of heating and assistant general manager of the Merchants' Heat & Light Company of Indianapolis, Ind., and earlier still was sales engineer for the Laclede Christy Company, St. Louis.

MERLE R. GRIFFETH, publicity manager of the Boston office, General Electric Company, at a recent meeting of the Boston Chamber of Commerce was the recipient of an honor cup fabricated from a 77-mm. shell for winning a drive for new members during the first twenty days of this month. Mr. Griffeth obtained sixty-six members and the next in the contest obtained twenty. A total of 152 new members was added, increasing the total chamber membership to more than 4100. The cup was bestowed by President Harriman, who is also president of the New England Power Company.

CHARLES B. BURLEIGH of the Boston office, General Electric Company, has been devoting considerable time since the signing of the armistice to the employment of returned service men, and as chairman of the employment committee of the Boston Chamber of Commerce has personally placed 2000 men in new positions among 300 firms. At the close of hostilities 190,000 Massachusetts men were in the service. Eighty-two per cent of these are returning to their former posts in civil life; 5 per cent place themselves, and 3 per cent are returning to educational institutions to complete interrupted courses.

THE ADVANCE ELECTRIC COMPANY of St. Louis expected to move into its new plant about June 10.

THE WORCESTER STAMPED METAL COMPANY, Worcester, Mass., has established a new sales office at 305 Merchants' Bank Bulding, Indianapolis, Ind., with Frank J. Coffey as manager.

THE TOOL EQUIPMENT COMPANY of San Francisco, Cal., has recently been authorized Western sales agent for the Geometric Tool Company. Offices are at 735 Folsom Street, San Francisco, Cal.

THE HARTFORD BATTERY MANUFACTURING COMPANY, 51 Elm Street, Hartford, Conn., is at present being equipped for an output of about $20,000 per month of automobile batteries and reports that it will soon begin shipments.

THE BRUNSWICK (GA.) CROSS-ARM COMPANY reports that it is placing orders for two additional fast-feeding machines and intends to build an addition to its plant 50 ft. by 100 ft., about doubling the present size, for the purpose of operating a complete planning mill and catering to export business.

THE MASSACHUSETTS MACHINE SHOP, INC., announces that it is moving its plant to its new factory at 817 Albany Street, Boston, where enlarged quarters and equipment will greatly increase its facilities. There was of necessity a short suspension of production on new work. Shipments of stock goods were not interrupted, however.

THE APPLETON ELECTRIC COMPANY, manufacturer of conduit fittings, Chicago, writes that it has opened up with several new distributers and hopes to do an increased business from now on. The company is adding to its sales force. H. F. Bloom, who has just returned from service, will travel the Chicago territory, and R. H. Robinson, formerly with the electrical department of the city of St. Louis, will travel throughout the South and Southeast, with headquarters in Atlanta or Birmingham.

THE FAULTLESS ANCHOR & MANUFACTURING COMPANY, formerly in Findlay, Ohio, is now at Centerburg, Ohio. The company has a new building with plenty of floor space, and it reports keeping a small force busy taking care of the anchor situation, which is very good considering conditions. At a recent meeting of the stockholders and directors quite a few changes were made in the personnel of the company. The present officers are: C. Bowen, president; H. T. Blosser, vice-president and general manager, and F. C. Bishop, secretary and treasurer.

THE NATIONAL CONDUIT & CABLE COMPANY, according to the *Wall Street Journal*, showed a deficit of $219,694 in the first quarter this year, compared with a deficit of $292,413 in the corresponding quarter of 1918. The stagnant condition which prevailed throughout the brass industry over the first three months of this year, it was stated, resulted in few companies earning sufficient to cover overhead, depreciation, etc. Companies which manufacture brass and copper products are not working at more than 50 per cent of capacity. Some of them are only handling one-third the business transacted in normal times. However, it is expected that June will witness a good buying movement on the part of wire, telephone, cable and telegraph companies, public utilities and the building trade.

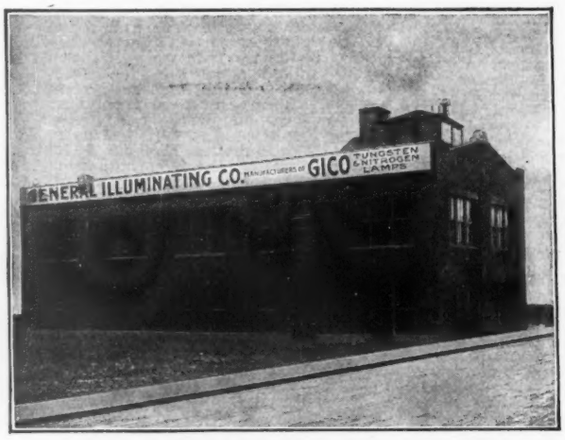
THE ALLIED MACHINERY COMPANY OF AMERICA has increased its capital stock to $5,000,000. This was made necessary by the decision of the American International Corporation to group all of its machinery export selling subsidiaries under one head. This move contemplates the complete absorption of the Allied Construction Machinery Corporation by the Allied Machinery Company of America. The Allied Machinery Company of France and the Allied Machinery Company of Italy will retain their corporate entities, but their parent corporation will be the Allied Machinery Company of America rather than the American International Corporation, as before. This is also true of the Horne Company, Ltd., of Japan, which was purchased early in the year by the American International Corporation. It is announced that J. W. Hook will continue as president of the Allied Machinery Company of America, in general charge of the business. F. A. Monroe, S. T. Henry and T. G. Nee have been elected vice-presidents. Mr. Monroe is in charge of the administrative affairs of the company. Mr. Henry is in charge of sales and advertising, and Mr. Nee is at present in Japan devoting his attention to the affairs of the Horne Company, Ltd. R. P. Redier is general sales manager of the company, with headquarters at Paris.

THE NITRO-TUNGSTEN LAMP COMPANY of Providence, R. I., has appointed the Ullman Electric Compaany of Boston, Mass., general sales agent for the Comet brand nitrogen lamp.

THE INTERNATIONAL INSULATING CORPORATION, Springfield, Mass., has increased its factory floor space by 15,000 sq.ft. and has recently completed tools and is now placing on the market a new switch.

SMITH & HEMENWAY, INC., Irvington, N. J., report that the demand for Red Devil tools, both for domestic and export consumption, is very good and increasing. The company has recently added some new tools to its line. Within the past year the company has enlarged its factory space considerably, adding a building of two stories, 110 ft. long by 50 ft. wide, besides considerable machinery and equipment.

THE GENERAL ILLUMINATING COMPANY announces that it has recently purchased its own factory at 5317-5321 Twenty-first Avenue, Brooklyn, N. Y., where it has greatly enlarged facilities for manufacturing standard tungsten lamps and nitrogen lamps under a patent license granted by the General Electric Company. The company formerly renewed tungsten lamps only, but now this policy has been entirely abandoned.



GENERAL ILLUMINATING COMPANY'S NEW LAMP FACTORY IN BROOKLYN, N. Y.

THE UNITED ELECTRIC COMPANY, Canton, Ohio, manufacturer of vacuum cleaners, has opened an office in the Builders' Exchange, Chicago, with Donn Mitchell and Leon C. Zimmerman in charge, the former handling the stationary line and the latter the portable line. The company has also opened a new office in Cleveland in the Builders' Exchange, with Jerry Snyder in charge, and an office at 321 Madison Avenue, New York City, with F. H. Schaefer in charge. A new storehouse is being built by the company this summer which will give it about one-third more space.

THE AUTOMATIC TRANSPORTATION COMPANY of Buffalo, N. Y., announces that since the first of the year its sales department has been under the direct charge of its vice-president, E. L. Kleindinist. Several new sales offices have been established and the company now has thorough representation in every part of the United States and Canada. A large addition to the company's plant has recently been built, affording additional facilities for the production of storage-battery trucks and tractors. In the last few months many improvements on various models of these machines have been made.

THE R. H. BEAUMONT COMPANY, 315 Arch Street, Philadelphia, manufacturer of conveying and hoisting systems, is expanding its business to take in complete boiler houses under one contract covering the entire job. R. H. Frost, formerly with John W. Cowper, Buffalo, N. Y., has been engaged to take charge of all matters pertaining to this branch of the business. He will coöperate with the company's engineering department in the design of a standard boiler-house structure. The company has opened an office in Cleveland, Ohio, with H. B. Mosley, formerly with the home office as manager. The Canadian Fairbanks-Morse Company, of Montreal, is representing the Beaumont company.

A. P. SAAS has resigned his position of treasurer and sales manager of the Independent Lamp & Wire Company, Inc., and of secretary and treasurer of the Rochester Bulb Company, effective June 15.

EDGAR M. MOORE & CO., 708 Farmers' Bank Building, Pittsburgh, Pa., has recently taken the representation of the Watson Wagon Company of Canastota, N. Y., for the sale of Watson tractor, trucks and trailers.

THE RICHARDSON SCALE COMPANY of Passaic, N. J., reports that it proposes to go more extensively into the export business, particularly in South America. W. R. Kent, sales manager, has been assigned to take charge of the export work.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY has added to its sales force A. J. McWilliams, who will make his headquarters in Pittsburgh and push the safety switch line for the company in the Pittsburgh district.

THE MURRAY IRON WORKS COMPANY, Burlington, Iowa, announces that S. C. Orrell, recently manager of the Minneapolis office of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has resigned to assume charge of the Chicago office of the Murray Iron Works Company.

THE CARBOLINEUM WOOD PRESERVING COMPANY, Milwaukee, Wis., announces that it has lately centralized its business, doing away with all former branches, distributers and agents, except only the Pacific Coast branch. All distributing will be done from stocks carried at different points with headquarters at the Carbolineum Building, Milwaukee, Wis.

THE SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., announces that R. C. W. Libbey is now visiting the Pacific Coast States with a view to securing new outlets for its smaller appliances and its new ranges. It has concluded arrangements with Holbrook, Merrill & Stetson of San Francisco and Los Angeles, Cal., to act as wholesale distributers for California, Arizona and Nevada.

THE REDTOP ELECTRIC COMPANY, INC., New York City, has established a new sales office in San Francisco, where sales are being handled by the Globe Commercial Company, of 618 Mission Street. The company has enlarged its factory twice during the last few months because it has increased its sales about 200 per cent. It reports that it is shipping all over the world, and its trade with China has developed of late considerably.

THE ELECTRIC SPECIALTY COMPANY, Stamford, Conn., manufacturer of motor generators, reports that it is erecting an addition to its factory which will double its present floor space. The addition is 100 ft. by 40 ft., two stories high. The company expects to have the addition ready for occupancy in about six weeks or two months. The addition is made with a view of doing a much greater export business than heretofore.

THE MACOMBER & WHYTE ROPE COMPANY, Kenosha, Wis., manufacturers of wire rope and wire, announces the opening of two new branches, one at New York City, at 30 Church Street, under the management of E. E. Robirds, who has been with the company for ten years, having previously been successively manager of the Pittsburgh and Chicago offices. Another office has been opened at Birmingham at 805 American Trust Bank Building, under the direction of James A. Boope. Complete stocks will be carried at both places.

THE DAYTON INSULATING DIE COMPANY, manufacturer of molded insulation products and dies for same, has just purchased the Edgemont Die Casting Company of Dayton, Ohio, manufacturer of white-metal castings, and will consolidate and operate both lines under a new name. C. A. Kurz will be president, and I. W. Detamore is also connected with the new organization. Ground was broken during the third week in May for a new plant, about 60 ft. by 120 ft., two stories, steel and concrete, situated at Edgemont, a suburb of Dayton, Ohio.

THE JAMES LEFFEL WATER WHEEL COMPANY has sold its plant in the Lagonda district, Springfield, Ohio, to the Robbins & Myers Company, and has acquired more extensive property in Springfield. Engineers and architects are at work on plans for a large, modern and fully equipped plant and construction work will be rushed so that the new plant will be ready for occupancy by Dec. 1. The company found itself cramped for factory space in its old quarters. The company has grown very rapidly since it started in 1862 with the inventions of James Leffel. In 1890 the business was incorporated under the name of James Leffel & Company and since then has expanded considerably. George R. Prout, president of the company, and other officers of the company have been identified with the business for many years.

Trade Publications

INSULATORS.—J-D insulators are the subject of a leaflet from the Jeffrey-Dewitt Insulator Company, Huntington, W. Va.

ELECTRIC TRUCKS. — A number of types of industrial electric trucks and tractors are shown and described in a pamphlet prepared by the Baker R. & L. Company of Cleveland.

WASHING MACHINE.—To tell about the "Mola" home laundry machine, the Modern Laundry Machine Company of Kansas City, Mo., has issued an illustrated folder.

ELECTRIC RANGE.—The new "Jewel" electric range manufactured by the Detroit Stove Works, Detroit and Chicago, is illustrated and described in a recently distributed circular.

MOLDINGS AND FITTINGS—The National Metal Molding Company, of Pittsburgh, Pa., is distributing an illustrated broadside on its interconnecting metal moldings and fittings.

ELECTRIC TRUCKS AND TRACTORS. —A mailing folder on electric trucks and tractors is being circulated by the Automatic Transportation Company, 2933 Main Street, Buffalo, N. Y.

VENTILATING FLOORING.—The Irving Iron Works Company, Long Island City, N. Y., has issued a thirty-six-page catalog, 2A, covering "Irving subway" fireproof ventilating flooring.

CENTRIFUGAL SEPARATORS.—The International Equipment Company, Boston, Mass., is distributing catalog C on centrifugal separators and other electrical apparatus for laboratories.

STOKER.—The Jones automatic cleaning underfeed stoker is described in an illustrated pamphlet published by the Under-Feed Stoker Company of America, Harris Trust Building, Chicago.

LIGHTING FIXTURES.—Two styles of lighting fixtures suitable for store lighting are illustrated in a recently issued leaflet of J. Livingston & Company, Grand Central Terminal, New York City.

ELECTRIC IRON.—The new domestic electric flatiron which the Simplex Electric Heating Company of 85 Sidney Street, Cambridge, Mass., is marketing is described in a folder recently issued.

LAMP AND SCALE REFLECTION INDICATOR.—The Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., has prepared a leaflet about its new lamp and scale reflection indicator.

CENTRIFUGAL PUMPS. — The Allis-Chalmers Manufacturing Company of Milwaukee is publishing a monthly bulletin containing a list of the centrifugal pumping units it has available for shipment.

ELECTRIC APPLIANCES.—A novel mailing folder is being circulated by the General Electric Division of the Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, containing reproductions in colors of its advertisements.

PORCELAIN PUSH-BUTTON SOCKETS.—"Sockets to Harmonize" is the title of an envelope stuffer which emphasizes the harmony to be secured through the use of C-H push-button porcelain sockets with white enamel fixtures as manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee.

ELECTRIC SIGNS. — Interchangeable day and night electric signs are spoken of in an illustrated mailing folder being distributed by the Flexlume Sign Company, Buffalo, N. Y.

ELECTRIC ELEVATORS.—The Warner Elevator Manufacturing Company of Cincinnati, Ohio, is circulating a mailing folder showing views in its factory and some of its products.

ELECTRICAL TOYS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York City, has prepared catalog No. 27, covering its toy electrical motors, transformers, telegraph sets, etc.

FANS, BLOWERS, HEATERS, AIR WASHERS.—The Massachusetts Blower Company, Watertown, Mass., has issued condensed bulletin No. 51, giving general data on its fans, blowers, heaters and air washers.

PLATE BATTERIES.—For its distributers and agents the Luthy Storage Battery Company of Newark, N. J., has prepared catalog No. 1 on replacements and parts for "Dependable" plate storage batteries.

OIL CIRCUIT BREAKERS.—The General Electric Company, Schenectady, N. Y., has prepared bulletins Nos. 47,417, 47,443 and 47,482, describing respectively type FP-7, type FK-13 and type FK-52B oil circuit breakers.

ELECTRICAL APPLIANCE SELLING HELPS.—"Helps in Merchandising Electrical Appliances" is the title given a sixteen-page two-colored bulletin issued by the Cutler-Hammer Manufacturing Company of Milwaukee.

SHOW-WINDOW ADVERTISING DEVICE.—The "Symmetriscope", a motor-driven advertising device for show-window use, is described in a circular being distributed by J. B. Beans, 1216 Land Title Building, Philadelphia.

SWITCHES, SWITCHBOARDS, CABINETS, ETC.—The Electrical Manufacturing Company of Cleveland has prepared a sixty-eight-page catalog, D, covering knife switches, panelboards, iron cabinets and switchboards.

CAPACITY BRIDGE. — The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, has issued bulletin No. 120 on capacity bridge and accessories. An odd stock list of the instruments sold by this company is also available.

COLOR MATCH UNITS.—"Chameleons Change Color" is the title of a booklet from the Nela Specialties Division, National Lamp Works of the General Electric Company, Nela Park, Cleveland, telling about its "Trutint" lighting units for color matching.

ELECTRIC APPLIANCES.—A novel mailing folder is being circulated by the General Electric Division of the Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, containing reproductions in colors of its advertisements in nationally circulated magaines.

LIGHTING FIXTURES.—Lighting fixtures for residences and public buildings, electrical conduit fittings and boxes and marine electrical appliances are the devices covered in a booklet issued by the Trans-Com. Lighting Products Corporation, 508 Broome Street, New York City.

STEAM POWER PLANTS.—The Murray Iron Works Company, Burlington, Iowa, is distributing catalog No. 85 of ninety-five pages, to describe and illustrate its Corliss marine, pumping and vertical engines, air compressors, tubular, marine, portable and water-tube boilers, and rocking grates.

SOLDERING IRONS. — "C-H Electric Soldering Irons and Hand Tools" is the title of a folder which illustrates and describes standard sizes of electric hand soldering irons, automatic soldering iron rack and a soldering fixture manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee and New York.

BOILER FEED REGULATION.—An eight-page bulletin embodying specifications for the Copes system of boiler-feed regulation has just been published by the Northern Equipment Company, Erie, Pa. The bulletn discusses the following points: Principle of operation, heat storage, reduction of furnace temperature fluctuations and sudden load change, service performance, constant characteristic, thermostat, control valve, standard dimensions and drilling, and the Copes steam-pump governor.

ELECTRIC TOASTERS.—Circular No. 189 from Manning, Bowman & Company, Meriden, Conn., covers four styles of electric toasters.

ELECTRIC BLOWER.—In a recently issued leaflet the Rosewater Electric Company, Cleveland, Ohio, tells about its "Roto" electric blower.

FLATIRON.—The Simplex Electric Heating Company, 85 Sidney Street, Cambridge, Mass., has printed an electric flatiron folder to be used by the trade for retail circularization.

ROOT CUTTERS.—The Superior Churn & Manufacturing Company of Northville, Mich., illustrates and describes an electrically driven root cutter in a recently issued circular.

New Incorporations

THE MALONE (WIS.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by John L. Beau, Frank Clark and Christ Pickart.

A. S. ELLIOTT & COMPANY of New York, N. Y., has been incorporated by A. S. Elliott, A. G. and S. Lichtenstein, 138 East 117th Street, New York City. The company is capitalized at $40,000 and proposes to manufacture electric and gas fixtures.

THE MARTALEX MANUFACTURING COMPANY of New York, N. Y., has been incorporated by A. Ascher, M. Fogel and A. Kutz, 320 Broadway, New York City. The company is capitalized at $10,000 and proposes to manufacture electrical devices.

THE AMERICAN SAFETY GAS BURNER COMPANY of Bridgeport, Conn., has been chartered with a capital stock of $25,000 by Samuel Rosenburg, Daniel J. Trivres and Bernard W. Ring. The company proposes to manufacture electric and gas fixtures.

THE ELECTRIC TWIN WATER PURIFICATION of Buffalo, N. Y., has been incorporated by J. Roche, R. J. Parker and H. W. Smead, 11 Tremont Avenue, Buffalo, N. Y. The company is capitalized at $100,000 and proposes to manufacture water filters.

THE WOLCOTT MANUFACTURING COMPANY of Hartford, Conn., has been incorporated by Frank E. Wolcott, H. C. Bailey and R. L. Gideon. The company is capitalized at $100,000 and proposes to manufatcure electrical tools and other specialties.

THE ALADDIN LAMP WORKS, INC., of New York, N. Y., has been chartered with a capital stock of $15,000 to manufacture electric lamps and equipment. The incorporators are R. S. and J. G. Turnbull and I. Castelli, 334 East Seventy-eighth Street, New York City.

THE F. B. ELECTRIC & MANUFACTURING COMPANY of Detroit, Mich., has been organized by John W. Fitzgerald of Detroit, Mich.; D. J. Buns of Bronxville, N. Y., and Albert J. Fisk. The company proposes to manufacture electrical and mechanical apparatus.

THE WEBB ELECTRIC FURNACE COMPANY of New York, N. Y., has been incorporated with a capital stock of $20,000 to manufacture electric furnaces and equipment. The incorporators are J. G. Webb, H. T. and E. C. Gerdes, 30 Church Street, New York City.

THE HAMILTON LAMP COMPANY of Hamilton, Ont., Can., has been incorporated with a capital stock of $300,000 by Lyman Lee, Thomas H. Simpson, R. Meyers and others. The company proposes to manufacture electric lamps, electrical equipment and fixtures, machinery, etc.

THE P. PHELPS LIGHT & POWER COMPANY of Rock Island, Ill., has been incorporated with a capital stock of $800,000 to construct and operate an electric light and power plant. The incorporators are: R. W. Phelps of Rock Island, Ill.; H. C. Thompson and A. G. Bush of Davenport, Iowa.

THE INCANDESCENT LIGHT & STOVE COMPANY of Cincinnati, Ohio, has been incorporated with a capital stock of $50,000 by Paul J. Connolly and others. The company, it is reported, will take over the plant of a company in Oakley, having the same name, which has not been in operation for some time.

New England States

BRANDON, VT.—The Hortonia Power Company Brandon, it is reported, is contemplating the construction of two dams and a hydroelectric power plant at Weybridge.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3946, for cranes for shipfitters' shop at Boston, Mass., to cost about $65,000. A deposit of $10 is required for plans.

HOLYOKE, MASS.—The Board of Aldermen is considering a proposal submitted by the Turners Falls (Mass.) Power & Electric Company to furnish electricity to operate the municipal electric light and power company. John J. Kirkpatrick is manager of the municipal plant.

MARION, MASS.—The Gas and Electric Light Commission has approved of an issue of $900,000 in capital stock by the Southeastern Massachusetts Power & Electric Company of Marion and Wareham.

NEWPORT, R. I.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3951, for a fire-alarm system at Newport, to cost about $15,000. A deposit of $10 is required for plans.

PROVIDENCE, R. I.—A permit has been granted to the Atlantic Mills for the erection of a new power house, 46 ft. by 98 ft., in the rear of Manto Avenue.

DANBURY, CONN.—The installation of an ornamental lighting system in the business section is under consideration by the City Council.

SOUTH NORWALK, CONN.—Plans are under consideration by the commissioners of the municipal electric light plant of the Second Taxing District of the city of Norwalk for enlarging the municipal electric plant to meet the increasing demand for electrical service. Frederick Hunkemeier is president.

Middle Atlantic States

AMSTERDAM, N. Y.—The J. W. Bishop Company of Boston, Mass., has been awarded the contract for the erection of a large woolen mill and power house at the plant of the Amsterdam Manufacturing Company.

BALDWINSVILLE, N. Y.—Franchises have been granted to the Seneca River Power Company in the villages of Cato and Meridian to furnish electrical service. Bonds to the amount of $15,000 have been sold to pay for the extension of the transmission line. Both villages will enter into contract with the company for street-lighting service.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until July 8 for furnishing, at South Brooklyn, under Schedule 4147, 175 portable electric drills.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until July 1, for new boiler, stokers, etc., and coal and ash-handling equipment for the new central heating and lighting plant at the Central Islip (N. Y.) State Hospital. Drawings and specifications may be consulted at the above institution, at the New York office of the Department of Architecture, Room 618 Hall of Records Building, and at the Department of Architecture, Albany. L. F. Pilcher, Capitol, Albany, is state architect.

GLENS FALLS, N. Y.—Application has been filed by the Adirondack Electric Power Corporation for permission to make extensions to its systems in Vernon, Westmoreland, Verona and Kirkland.

NEW YORK, N. Y.—Bids will be received by E. S. Walsh, Superintendent of Public Works, Capitol, Albany, until July 15 for furnishing and installing industrial freight-handling trailers and stevedore freight-handling trucks for barge canal terminals in New York City, under terminal contract No. 112. Plans and specifications may be seen at the office of the Superintendent of Public Works, Albany, at the office of the Assistant Superintendent of Public Works for the Middle Division at Syracuse, at the office of the Assistant Superintendent of Public Works for the Western Division at Rochester, at the canal office, Spaulding's Exchange, Buffalo, and at the office of the State Engineer, Hall of Records, New York City.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Ophuls, Hill & McCreery, Inc., have been retained as architects and engineers to design and supervise the construction of a fish-freezing plant for the French government on the Isle of St. Pierre, off the coast of Newfoundland. Specifications for the mechanical, electrical and refrigerating apparatus will be ready to be issued on June 21. The proposed equipment will include 400 hp. in water-tube boilers, four 50-hp. uniflow engines directly connected to 75-ton refrigerating machines, two uniflow engines directly connected to 150-kva. generators, concrete or brick stack, 125 ft. by 5 ft.; brine pumps, water pumps, circulating pumps, together with two 25-ton ice-making tanks, switchboards, wiring, etc., for electrical installation. The cost of the entire project is estimated at between $600,000 and $700,000. The offices of the engineers are at 112 West Forty-second Street, New York.

OSSINING, N. Y.—Bids will be received by C. F. Rattigan, superintendent of state prisons, Hall of Records Building, New York City, until June 24 (extension of date from June 17) for construction of mess hall and kitchen No. 4, detention building No. 5, outside cell building No. 7, clinic building No. 8, pump house and reservoir, and also for sanitary heating and electric work on same. L. F. Pilcher, Capitol, Albany, is state architect.

SARATOGA, N. Y.—The City Council has decided to install a new lighting system on Broadway and in the parks. It will be installed by the Adirondack Electric Power Corporation, which will maintain it, and the city will pay $13,300 per year.

SCHENEVUS, N. Y.—The Board of Village Trustees has applied to the Public Service Commission for permission to construct and operate an electric light plant and transmission system through the towns of Maryland and Milford. Bonds to the amount of $22,000 have been voted to cover the cost of the project.

BORDENTOWN, N. J.—Arrangements are being made by the Public Service Electric Company for the erection of an electric transmission line to the municipal waterworks to supply electricity for operating the pumping units. The cost of the entire work is estimated at about $15,000.

CAPE MAY, N. J.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3963, for floodlighting system at Cape May, to cost about $4,000. A deposit of $10 is required for plans.

ORANGE, N. J.—Plans have been filed by the Hart Roller Bearing Company, 25 Main Street, for a power plant to be erected in connection with its new roller bearing works now under construction.

BETHLEHEM, PA.—Bids will be received until July 14 by H. J. Judd, superintendent, for construction of high school building, to cost about $800,000. V. T. Ritter, North American Building, Philadelphia, is architect.

GROVE CITY, PA.—Plans have been prepared by Sidney B. Martin, engineer, Penn Building, Pittsburgh, for additional units for the municipal electric light plant.

HONESDALE, PA.—Contract has been awarded to Kreitner Brothers for the construction of the new electric light plant for the Honesdale Consolidated Light, Heat & Power Company.

McKEESPORT, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 25 for installation complete of an electric mail elevator, etc., in the United States post office at McKeesport. For details see Searchlight Section.

PHILADELPHIA, PA.—Bids will be received by the Department of City Transit, 1211 Chestnut Street, until June 24 for the following work on the Frankford Elevated Railway: Contract No. 567, installation of electric conduits for lighting system in the stations to be built at the corner of Kensington and Allegheny Avenues and the corner of Kensington Avenue and Somerset Street; contract No. 568, installation of water and drainage lines in the above stations. Plans and specifications may be obtained at the above office upon deposit of $10. William S. Twining is director.

SHENANDOAH, PA.—Plans are being prepared by Gannett, Seelye & Fleming, engineers, 204 Locust Street, Harrisburg, for improvements to the waterworks system, including pumping station, pumps, motors, etc. D. T. Grover is city engineer.

BALTIMORE, MD.—Plans are being prepared for the erection of a three-story power plant at the Church Home and Infirmary, Broadway and Fairmont Avenue. Wyatt & Nolting, Keyser Building, are architects.

INDIANHEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3924, for extension to power plant at Indianhead, to cost about $200,000. A deposit of $30 is required for plans.

MARTINSBURG, W. VA.—The Potomac Light & Power Company is planning to rebuild its local substation, damaged by fire. The cost is estimated at about $12,000.

SOUTH CHARLESTON, W. VA.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 27, under Schedule 4099, for three electric locomotives, rack drive, at South Charleston.

SOUTH CHARLESTON, W. VA.—Contract has been awarded by the South Charleston Utilties Company for the erection of a new electric light plant and distribution system to the Engineering Service Company of Charleston. The cost is estimated at $15,000.

HAMPTON ROADS, VA.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 27, at Hampton Roads, under Schedule 4115, for one motor-generator set.

HAMPTON ROADS, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3960, for a fire-alarm system at Hampton Roads, to cost about $6,000. A deposit of $10 will be required for plans.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 24, under Schedule 4109, for miscellaneous flashlights and batteries at the various navy yards.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 30 for supplying to the various buildings under the control of the Treasury Department hand electric portable vacuum cleaners during the fiscal year ending June 30, 1920, in accordance with specifications, copies of which may be obtained at the above office.

North Central States

BATTLE CREEK, MICH.—The Advance Pump & Compressor Company is planning to build a foundry, machine shop and power house.

MIDLAND, MICH.—The Village Council is considering the installation of an electric lighting system, to cost about $15,000.

LEBANON, OHIO.—Plans are under consideration by the Village Council for the construction of a new electric light plant, to cost about $120,000. An election will be called to submit the proposal to the voters.

LORAIN, OHIO.—The Lorain County Electric Company is contemplating improvements to its local system, involving an expenditure of about $90,000.

NORTHFIELD, OHIO.—Bonds to the amount of $35,000 have been issued for the installation of an electric lighting system. Electricity will be secured from the Northern Ohio Traction & Light Company.

NORWOOD, OHIO.—The business men of Norwood have petitioned the City Council to grant the Union Gas & Electric Company of Cincinnati a franchise to supply electricity in Norwood for manufacturing purposes. The municipal plant is not able to provide the power required.

SPRINGFIELD, OHIO.—Plans are being prepared by the James Leffel Company for enlarging and equipping the plant of the Columbia Planer Company, which it recently acquired for the manufacture of water turbines.

WELLINGTON, OHIO.—Bonds to the amount of $50,000 have been voted for the extensions and improvements to the municipal electric lighting system.

JEFFERSONVILLE, IND.—Plans have been completed for improvements at the local government depot, to cost more than $100,000.

MEDORA, ILL.—The village of Medora is considering the purchase of the local electric light plant, owned by L. C. Hard.

ORION, ILL.—The Illinois Public Utilities Commission has granted the Sherrard power system permission to erect an 11,000-volt transmission line from a point on its line south of Coal Valley to the village of Milan, and also to supply electrical service to residents along the route of the proposed transmission line.

SEYMOUR, ILL.—The Interstate Public Service Company is planning to erect a high-tension transmission line from its substation in Greenwood to its hydroelectric power station at Williams.

ASHLAND, WIS.—The municipal electric plant was recently damaged by fire, causing a loss of about $10,000.

PORT WASHINGTON, WIS.—The City Council is considering an issue of $30,000 in bonds for extensions and improvements to the municipal electric light plant.

MINNEHAHA FALLS, MINN.—Bids will be received by the Soldiers' Board, care C. F. Dolan, quartermaster, Minnesota Soldiers' Home, Minnehaha Falls, until June 24 for furnishing and installing the following equipment: (1) Engine, (2) generator, (3) electric elevator, (4) fire-alarm system, (5) refrigerating plant, at the above institution, in accordance with plans and specifications prepared by the Charles L. Pillsbury Company, engineer, Minneapolis and St. Paul.

TYLER, MINN.—The purchase of additional equipment for the municipal electric light plant is under consideration by the Village Council. When improvements are completed a twenty-four-hour service will be established.

NEWTON, IOWA—The Des Moines (Iowa) Electric Company, it is reported, has entered into a contract to supply electricity in Newton for a period of eight years. Plans are being prepared for the construction of a plant here in the near future, to cost about $90,000.

ST. JOSEPH, MO.—Bonds to the amount of $500,000 have been voted for extensions and improvements to the municipal electric light plant. Archer & Stevens, New England Building, Kansas iCty, Mo., are engineers.

ST. LOUIS, MO.—Bids will soon be asked by the Board of Public Service for the construction of two warehouses, one 120 ft. by 200 ft. and the other 200 ft. by 400 ft., including eleven concrete freight platforms, cranes, etc., to cost about $300,000. J. A. Hook is city engineer.

ST. LOUIS, MO.—A permit has been taken out by the St. Louis Manufacturing Corporation, a subsidiary of the General Motors Corporation, for the construction of additional units in connection with the branch plant now under construction. The plans provide for a power plant, to cost about $500,000.

AMENIA, N. D.—Bids will be received by the Amenia & Sharon Land Company of Amenia until June 27 for furnishing materials and construction of an electric lighting and power system and motor drive as follows: (1) For brick and tile power house; (2) furnishing and installing oil engines, necessary piping and accessories, two three-phase, 60-cycle, 2300-volt alternators with exciters, switchboard, etc.; (3) electrical distribution system, consisting of furnishing and erecting poles, wires, street lamps, transformers, etc., in the village of Amenia; (4) furnishing and erecting motors and wiring for motor drive in three elevators in Amenia. Plans and specifications may be obtained on application to Earle D. Jackson, consulting engineer, Capital Bank Building, St. Paul, Minn., for which a charge of $4 will be made to cover cost of printing and mailing. H. L. Chaffee is secretary of the company.

HICKMAN, NEB.—Plans are being prepared by Grant, Fulton & Letton, Bankers' Life Building, engineers, Lincoln, for the erection of an electric transmission line from Lincoln to Hickman and an electric distribution system in the town. An election will soon be called to submit the proposal to the voters. The cost is estimated at $16,000.

PHILLIPS, NEB.—Bonds have been voted for the erection of an electric transmission line from the transmission system of the Grand Island Power Company to Phillips.

ALEXANDER, KAN.—The erection of an electric transmission line from McCracken to Alexander is under consideration.

CHANUTE, KAN.—An election will soon be called to vote on the proposal to issue $60,000 in bonds for extensions to the municipal electric lighting service.

HERNDON, KAN.—The City Council is considering the installation of additional street lamps.

MULVANE, KAN.—Henrici & Lowry, engineers, 222 Commerce Building, Kansas City, Mo., have been engaged to prepare plans for the proposed new electric plant in Mulvane.

ROSSVILLE, KAN.—The Rossville Electric Light & Ice Company, it is reported, is preparing plans for the construction of a new power house.

OSAWATOMIE, KAN.—Bids, it is understood, will soon be asked for the installation of an oramental lighting system, to cost about $12,000. The plans call for cast-iron poles mounted with a single lamp. Black & Veatch, Inter-State Building, Kansas City, Mo. are enigneers.

Southern States

UNION, S. C.—Arrangements have been made whereby electricity for the municipal electric light and power system will be supplied from the plant of the Lockhart Power Company on Broad River near Lockhart, for a period of ten years. Under the terms of the contract transmission lines will be erected to the Monarch Mills, where power will be received until the plant on the Broad River is completed. The present power plant will be maintained by the city for use in case of emergencies.

DUBLIN, GA.—A committee has been appointed by the Merchants' Association to meet the Light and Water Commission for the purpose of securing additional electricity for industrial purposes.

MILLEDGEVILLE, GA.—Bids will be received by the trustees of the Georgia State Sanitarium, Milledgeville, until July 1, for construction of nurses' home, including heating system and electric lighting, etc. The cost is estimated at about $125,000. Plans and specifications may be obtrained at the office of T. H. De Saussure, Georgia State Sanitarium, and from A. Ten Eyck Brown, architect, Forsyth Building, Atlanta.

COLDWATER, MISS.—Bonds to the amount of $10,000 have been voted for the installation of a street-lighting system and the erection of an electric transmission line from Senatobia.

LEXINGTON, MISS.—Bonds to the amount of $40,000 have been voted for the installation of a municipal electric light plant in Lexington.

CONWAY, ARK.—Extensions and improvements, involving an expenditure of about $50,000, to the municipal electric light plant are under consideration.

MARIANNA, ARK.—The Arkansas Corporation Commission has instructed the Arkansas Light & Power Company to make improvements to its local plant, among which are included the installation of new boilers and pumps, overhauling engines, installation of additional machinery and equipment, repairing of switchboard, additional street lamps, etc.

AFTON, OKLA.—Bonds to the amount of $10,000 have been authorized for improvements to the municipal electric light plant and $18,000 in bonds for extensions to water system.

HUGO, OKLA.—H. R. Jones and others of Hugo are contemplating the construction of a flour mill here, to cost about $50,000. A power plant, it is understood, will be installed in connection with the project.

KEOTA, OKLA.—The Midland Valley Coal Company, it is reported, is in the market for coal mining and power plant equipment, to cost about $20,000. A. U. Davidson and others are interested in the company.

NEWKIRK, OKLA.—Bonds to the amount of $185,000 have been voted for extensions to the water and lighting systems.

TONKAWA, OKLA.—Plans are being prepared for improvements to the municipal electric light plant and waterworks system. The Benham Engineering Company, Colcord Building, Oklahoma City, is engineer.

DALLAS, TEX.—The Dallas Power & Light Company is contemplating the construction of a substation, to cost about $250,000.

ENNIS, TEX.—The installation of a municipal electric light plant in Ennis is under consideration.

HOUSTON, TEX.—Preparations are being made by the Mack Oil & Water Well Screen Company, Kress Building, Houston, for the construction of a new plant, to cost about $200,000. The plant will be equipped with electrically operated machinery. J. O. Mack is manager.

Pacific and Mountain States

HOQUIAM, WASH.—The Western Rolling Mills Company, which is building a steel mill in Hoquiam, is reported to be in the market for machinery, including cranes, open-hearth furnaces, and later on an electric furnace. About 1200 hp. in motors will also be required for the proposed plant. Power will be purchased from the Gray's Harbor Railway & Light Company.

OROVILLE, WASH.—Preparations are being made by the Okanogan Valley Power Company for the construction of a dam on the Similkameen River, 3½ miles above Oroville. The proposed dam will be 350 ft. long and 60 ft. high and will be built above the falls, which will give a total head of 80 ft. The first of the new units, it is estimated, will develop 2000 hp. The cost of the first unit is estimated at about $150,000. Eugene Enloe of Spokane is president.

SEATTLE, WASH.—In a communication to the City Council, J. D. Ross, superintendent of the municipal electric plant, states that the municipal plant is taxed to the limit and recommends an appropriation of $764,360 for the installation of a third unit of 15,000 kw. in the Lake Union steam plant immediately.

VANCOUVER, WASH.—The installation of cluster lamps on Washington and Main Streets is under consideration by the Commercial Club. Plans have been submitted by the Portland Railway, Light & Power Company for installation of the lamps.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has filed application with the State Engineer for storage of 40,400 acre ft. of water from Oak Creek for development of power along the Clackamas River. The cost of the reservoir is estimated at about $300,000.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 25, under Specification 3903, for electric traveling cranes for a structural shop at Mare Island, to cost about $250,000. A deposit of $10 is required for plans.

VENTURA, CAL.—Plans are being prepared by A. C. Martin, architect, Higgins Building, Los Angeles, for the erection of a County Hospital in Ventura, to cost between $150,000 and $200,000. The plans provide for hospital building, service and power house, nurses' home, residence building and four cottages.

IDAHO FALLS, IDAHO.—The Utah Power & Light Company of Salt Lake City, Utah, it is reported, is contemplating further developments in this section, including the erection of an electric transmission line from McCammon to Shelley, where it will connect with its present system serving the territory from Idaho Falls to Ashton. Another transmission line will also be built from Idaho Falls to St. Anthony. The company has entered into a contract with the Idaho Dry Farm Development Company to furnish energy for pumping operations.

Canada

PORTAGE LA PRAIRIE, MAN.—The by-law authorizing the construction of hydroelectric stations between Winnipeg and Portage la Prairie, to cost $275,000, has been approved by the ratepayers.

BROCKVILLE, ONT.—The Brockville Public Utilities Commission is considering equipping the Brockville and Westport branch of the Canadian government railway for electrical operation. The line is 45 miles long and serves a farming section.

PORT ARTHUR, ONT.—Bids will be received by M. H. Macleod, vice-president Canadian National Railways, 27 Wellington Street, Toronto, until June 30 for the construction of the superstructure of a grain elevator workhouse of 700,000 bushels capacity, with unloading shed and complete elevator equipment.

TORONTO, ONT.—Plans have been prepared by J. M. Jeffrey, architect, Confederate Life Building, for the erection of a theater on Victoria Street for the Paramount Film Company, 21 Adelaide Street West, to cost about $600,000.

SHAWINIGAN FALLS, QUE.—Bids will be received by the Town Council until July 1 for the construction of an electric light plant, to cost about $35,000. B. S. Atkins is engineer.

SWIFT CURRENT, SASK.—The municipal electric plant was recently destroyed by fire, causing a loss of about $60,000. The plant, it is understood, will be rebuilt and new equipment purchased.

Record of Electrical Patents

Notes on United States Patents

(Issued May 27, 1919)

1,305,202. WAVE METER; Harold P. Donle, Meriden, Conn. App. Dec. 15, 1917. Inductance and capacity in compact form.

1,305,213. PICKLING FERROUS ARTICLES AND ELECTRICALLY REGENERATING THE PICKLING BATH; Addison F. Hoffman, Pittsburgh, Pa. App. filed Jan. 23, 1917.

1,305,225. PRINTING TELEGRAPH; Charles Meriden, Conn. App. filed Dec. 15, 1917. Ill. App. filed Nov. 29, 1909.

1,305,227. ELECTRIC METER; Paul M. Lincoln, Pittsburgh, Pa. App. filed May 18, 1915. Produces a load-factor meter.

1,305,234. LIGHTING FIXTURE; Robert F. Pierce, Collingswood, N. J. App. filed June 1, 1915. Wide distribution.

1,305,240. AUXILIARY DEVICE FOR THE ETCHING OF ARCH-SHAPED WOLLASTON WIRES FOR THE HEAT CONDUCTORS OF THERMIC TELEPHONES; Robert Aernout Baron van Lynden, Utrecht, Netherlands. App. filed March 22, 1919.

(Issued June 3, 1919)

1,305,247. MANUFACTURE OF ELECTRIC CABLES; Charles J. Beaver, Hale, Eng. App. filed Nov. 27, 1918. Twin-core cable composed of two conductors.

1,305,250. MANUFACTURE OF DRY CELLS; Charles F. Burgess, Madison, Wis. App. filed Oct. 20, 1917.

1,305,251. MANUFACTURE OF DRY CELLS; Charles F. Burgess, Madison, Wis. App. filed Oct. 20, 1917.

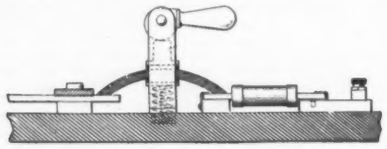
1,305,252. MANUFACTURE OF DRY CELLS; Charles F. Burgess, Madison, Wis. App. filed Oct. 20, 1917.

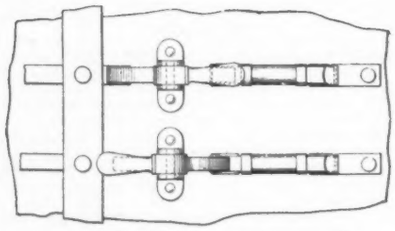
1,305,255. INDICATOR; William A. Dorais and Joseph B. Feise, O'Fallon, Mo. App. filed March 19, 1915. For use in railway trains.

1,305,268. CIRCUIT CONTROLLER; Clarence T. Evans, Milwaukee, Wis. App. filed April 15, 1916. Effects commutation and phase reversal of the windings of alternating-current motors.

1,305,285. ADJUSTABLE FIXTURE FOR ELECTRIC LAMPS; Charles A. Hinsdill, Troy, N. Y. App. filed Dec. 12, 1914. Mounted on pipe which serves as conduit.

1,305,295. INCANDESCENT ELECTRIC LAMP; Clarence H. McKay, Reading, Mass. App. filed Jan. 2, 1918. Incandescing member of thin sheet material having parallel sides.





1,305,376—Switchboard Mechanism

1,305,308. ELECTRIC PLUG AND SOCKET; Frederick W. Richter, St. Louis, Mo. App. filed April 12, 1917. Means for adjusting the contact shanks vertically.

1,305,315. TIRE-DEFLATING INDICATOR; Albert L. Stahl, Memphis, Tenn. App. filed March 30, 1918. Eliminates rim-cut tires.

1,305,323. CUTTER FOR PERFORATING MUSIC SHEETS; Bartolome Vergara, Mexico, Mexico. App. filed March 15, 1918. Includes a set of cutting knives.

1,305,350. EXTRACTION OF MOLYBDENUM; Tormod Reinert Forland, Haugesund, Norway. App. filed April 15, 1918. Free from carbon.

1,305,352. AUTOMOBILE-THEFT DETECTOR MEANS; Travilla C. Gettell, Philadelphia, Pa. App. filed Feb. 26, 1917. Sounds an alarm.

1,305,360. ALTERNATING-CURRENT WELDING TRANSFORMER; Claude J. Holslag, Peekskill, N. Y. App. filed Oct. 24, 1917. Self-controlled apparatus; gives proper heat control.

1,305,361. ALTERNATING-CURRENT WELDING TRANSFORMER; Claude J. Holslag, Peekskill, N. Y. App. filed Jan. 14, 1918. Portion of the secondary winding is commingled with the primary winding, and the remainder of the secondary winding is wound on the core remote from the primary.

1,305,362. METHOD OF ELECTRIC ARC WELDING, CUTTING AND REPAIRING; Claude J. Holslag, Peekskill, N. Y. App. filed April 30, 1918. Constant rate of energy at the arc.

1,305,363. ALTERNATING-CURRENT METALLIC-ARC CUTTING AND WELDING APPARATUS; Claude J. Holslag, Peekskill, N. Y. App. filed Sept. 21, 1918. With closed-circuit core transformer.

1,305,374. SWITCHBOARD; Hubert F. Krantz, Brooklyn, N. Y. App. filed May 19, 1913. Allows busbars to get more insulated air space.

1,305,375. MOTOR-STARTING SWITCH; Hubert F. Krantz, Brooklyn, N. Y. App. filed Feb. 18, 1916. Two switch units may be operated from a single hand.

1,305,376. SWITCHBOARD MECHANISM; Hubert Krantz, Brooklyn, N. Y. App. filed June 16, 1917. Eliminates inter-exposed joints and extensions between fuse and switch-blade.

1,305,381. RELAY; Walter S. Levin, San Francisco, Cal. App. filed May 5, 1915. Line-circuit train signaling and stopping apparatus.

1,305,394. STOVE CONSTRUCTION; Robert H. Miller, Detroit, Mich. App. filed May 12, 1917. Insulated walls are built up of blocks.

1,305,443. ELECTROLYTIC CELL; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 5, 1917.

1,305,458. ELECTROLYTIC CELL; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed April 4, 1917. Long, narrow and deep trough composed of sheet aluminum, magnesium, tantalum or other filming metal.

1,305,485. COMPOSITION FOR THE MANUFACTURE OF DRY CELLS; George W. B. Nefe and Emanuel A. Jenkins, Sandy, Utah. App. filed May 20, 1918.

1,305,495. APPARATUS FOR EXCITING ROENTGEN-RAY TUBES; Frank Rieber, San Francisco, Cal. App. filed Jan. 29, 1917. Potential applied to the Roentgen tube may be altered.

1,305,503. SPOT-WELDING; Waddy R. Thomson, Lancaster, S. C. App. filed July 9, 1917. Method of splicing steel-bale strapping.

1,305,514. CURRENT INDICATOR; Arthur F. Berry, Ealing, England. App. filed May 12, 1917. Indicates whether heating device is in operation.

1,305,525. TRANSMITTING APPARATUS; John J. Comer, Chicago, Ill. App. filed March 25, 1914. Needle vibrates perpendicularly to the surface of the phonograph record.

1,305,536. PRINTING-TELEGRAPH RECEIVER; Harry V. Grotjohann, Chicago, Ill. App. filed May 10, 1918. Prevents the wheel carriage from advancing beyond a predetermined position.

1,305,541. ROTARY SNAP SWITCH; John P. Hayes and John E. Barnhart, Pittsburgh, Pa. App. filed July 17, 1917. Contacts are rotated into and out of operative connection.

1,305,559. TIMER; Henry W. Muhleisen and Clemmen Lund, Los Angeles, Cal. App. filed Oct. 21, 1918. Combined rolling and sliding contact.

1,305,601. IGNITION DEVICE FOR MOTOR-VEHICLES; John A. Heany, New Haven, Conn. App. filed July 27, 1910. Single unit.

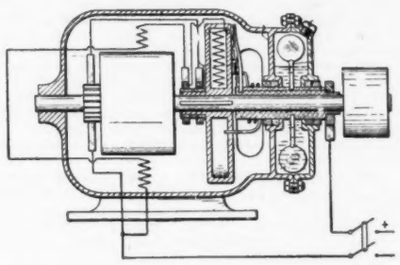
1,305,604. CORE MEMBER FOR DYNAMO-ELECTRIC MACHINES; George H. F. Holy, Pittsburgh, Pa. App. filed July 14, 1915. Turning plates is prevented.

1,305,609. DIRECTION INDICATOR FOR AUTOMOBILES; Thomas F. Kiernan, Salida, Cal. App. filed June 12, 1917. Mounted at rear.

1,305,610. FLOOR BOX; Hubert Krantz, Brooklyn, N. Y. App. filed Sept. 27, 1915. Water-tight.

1,305,611. OUTLET BOX; Hubert Krantz, New York, N. Y. App. filed May 4, 1916. Electrical connection with the supply mains is automatically controlled.

1,305,612. ELECTRICALLY CONTROLLED CLUTCH; Walter Langdon-Davies, Weybridge, Eng. App. filed May 5, 1917. Electromagnetic.



1,305,961—Speed-Controlled Rheostat

1,305,620. TELEGRAPH SYSTEM; Edwin Pope, Quebec, Canada. App. filed June 10, 1915. Number of independent messages may be simultaneously transmitted over the same wire.

1,305,649. CIRCUIT INTERRUPTER FOR TRAFFIC SIGNALS; Otto Freytag, Boise, Idaho. App. filed May 11, 1917. Mechanically driven device for the purpose of making and breaking the electrical circuit at short intervals.

1,305,657. SEPARATOR AND SECONDARY BATTERIES; Joseph O. Luthy, San Antonio, Tex. App. filed Jan. 16, 1919. Little resistance to the flow of the fluid.

1,305,658. SEPARATOR FOR SECONDARY BATTERIES; Joseph O. Luthy, San Antonio, Tex. App. filed Jan. 16, 1919. Permits free flow of the fluid from one battery plate to the other.

1,305,690. GRID-MAKING MACHINE; Henry S. Coyer, New York, N. Y. App. filed May 7, 1918. Automatically winds wire around two separated supporting posts.

1,305,712. INSULATOR CAP; Walter T. Goddard, Victor, N. Y. App. filed Dec. 8, 1917. Permits making the entire structure of stamped sheet metal.

1,305,725. ELECTRIC MASSAGE MACHINE; Charles W. Kent, Peoria, Ill. App. filed July 5, 1918. Strength of the secondary current may be varied.

1,305,814. ELECTRIC ACCUMULATOR PLATE; Henry Leitner, Westminster, London, England. App. filed Dec. 16, 1918. Lead sulphuric-acid bipolar type.

1,305,816. SPARK-GAP DEVICE; Fritz Lowenstein, Brooklyn, N. Y. App. filed Aug. 25, 1914. Quenched.

1,305,836. SIGNAL; Ferdinand L. Schoening, Brooklyn, N. Y. App. filed July 18, 1917. For broken wire in stitching machine.

1,305,937. ELECTROMAGNETIC OVERLOAD DEVICE; Charles H. Ripple, Cleveland, Ohio. App. filed July 6, 1917. Inverse time element.

1,305,961. SPEED-CONTROLLED RHEOSTAT; Hubert A. Burgess, Seattle, Wash. App. filed Dec. 5, 1917. Automatically regulates the current supplied to the armature and field coils of an electric motor in proportion to the demand to enable the motor being started from rest and accelerated to operate without injuring the motor.

1,305,963. OIL-GAGE SIGNAL AND CIRCUIT BREAKER; Herbert M. Dickerson, Evansville, Ind. App. filed May 10, 1917. Breaks ignition circuit of internal-combustion engine when oil falls below certain level.